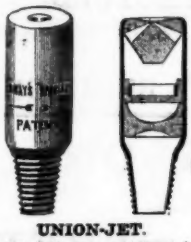
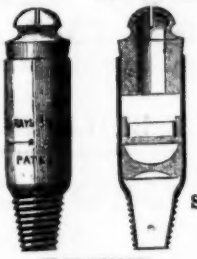
# DESCRIPTIVE CATALOGUE
OF
# BRAY'S "ENAMEL" GAS-BURNERS.

In presenting this Catalogue, we wish it to be known that we are the only Manufacturers in Great Britain of Non-Corrosive Slit-Union Burners. We make them under Patents taken out here, and in several Foreign countries, of our own material, "Enamel," which is much harder and less brittle than "Steotite" (of which the imported Slit-Unions are made), and, therefore, less liable to fracture. We may also state that our burner factory is the most extensive in the World, and the only one in which composite Non-Corrosive Gas-burners are made *in all their parts*,—facts which give us the power of meeting the various requirements of gas illumination in a way that cannot be accomplished by those who make up burners from parts which are purchased from widely scattered sources.

## BRAY'S "SPECIAL"



All these Burners are stamped with Trade Mark as shown in wood cut.



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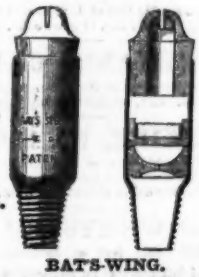

UNION-JET. SLIT-UNION. BAT'S-WING.

We believe our "Special" Burners, as improved, are more adaptable to the requirements of gas illumination than any now before the public. They can be made to suit any pressure or quality of gas (including air gas), give a well-shaped and steady flame, the gas inlet is so placed that it cannot be tampered with, and they are not liable to get out of order.

**TWO DISTINCT CLASSES** of burners are made, as regards lighting power—viz., for "*Highest Lighting Power*," and "*Medium Lighting Power*."

**THE HIGHEST LIGHTING POWER CLASS** are made to develop the greatest possible amount of light as tested in the Laboratory, and they surpass those supplied by any other maker or dealer, whatever the price charged. When this class is required, it must be distinctly stated so when ordering, at the same time giving quality of gas, and consumption required.

**THE MEDIUM LIGHTING POWER CLASS** are those which our experience leads us to recommend for general use, in preference to any which yield in the Laboratory the highest lighting power. The latter, whoever they are made by, will always be within, or near, the smoking point, and smoke freely with the slightest atmospheric commotion. To avoid the evils arising from these features, we recommend our medium lighting-power burners, the flames of which are kept well away from the smoking point, and are made to withstand atmospheric commotion better than the other class; and will do good service at a lower pressure, and give, we doubt not, *in general use*, as much light. All our "Special" burners are sent out of "Medium Lighting Power Class," unless otherwise ordered.

**THE SIZES OF BURNERS** are from No. 0 to 9 inclusive.

**FOR SIXTEEN-CANDLE GAS** (or 14 to 18 candles), the sizes from No. 4 to 9, inclusive, are those which yield the best results from 4 feet of gas and upwards; the lower numbers are for less consumptions.

**FOR TWENTY-CANDLE GAS** (or 19 to 22 candles), the sizes from No. 3 to 8, inclusive, yield the best results from 3 feet of gas and upwards; the lower numbers being for less consumptions.

**FOR TWENTY-FIVE CANDLE GAS** (or 23 to 27 candles), the sizes from No. 4 to 9, inclusive, yield the best results from 2½ feet and upwards. When burners are required for this quality, "for Cannel gas" must be distinctly stated when ordering.

**FOR OTHER QUALITIES OF GAS** (including air gas), burners are made to order.

**PRESSURE.** All our "Special" burners are made (unless otherwise ordered) to give a suitable spread of flame at five-tenths pressure, and keep in good shape up to twenty-tenths; but we make to order suitable for any specified pressure up to forty-tenths.

**STREET-LAMPS.** For this purpose these burners are of exceptional value. Those suitable for consumptions of, say, 3, 4, or 5 feet per hour may be made to consume that quantity at any specified pressure from five-tenths to forty-tenths; therefore, a selection of burners may be had, adapted to the several pressures of a town, by the use of which the consumption in the lamps may be balanced with a nicety not equalled by the ordinary working of governors, with the further great advantage of a reduced consumption, when the light is not required, by the usual reduction of pressure in the street-mains at midnight. In ordering for this purpose, it is necessary to state the quality of gas, the consumption, and the number of burners required for each pressure. Extended particulars on this subject will be supplied on application.

**FITTINGS.** We make our burners to suit the fittings of any country, but, unless otherwise ordered, they are sent out English taper-screw.

**FOR GLOBES,** the "Bat's-wings" are not suitable, the "Union-Jets" and the "Slit-Unions" are.

## BRAY'S "ENAMEL" REGULATORS.

All these Burners are Stamped "Bray's Patent Enamel Regulator," as shown in wood cut.

All these Burners are Stamped "Bray's Patent Enamel Regulator," as shown in wood cut.

UNION-JET. SLIT-UNION. BAT'S-WING.

**THE NAME** "Regulator" was given to these burners when introduced eleven years ago, because burners having a medium in their interior for gas to pass through, had then become known as "Regulators." Our Union-Jets and Bat's-wings were originally introduced (and now the Slit-Unions are added) to remove two defects in the common metal burners—corrosion and roaring flames,—and our enterprise has been so far successful that the metal burners have been almost supplanted. A steady well-shaped flame is produced by the combined excellence of the tip and the medium through which the gas has to pass in the interior of the burner.

**LIGHTING POWER.** Though their lighting power is not equal to the "Specials," nor so much under control, yet they are far superior, in this respect, to the common metal burners, with which they closely correspond in price.

**THE SIZES** are, in Union-Jets and Slit-Unions, Nos. 0 to 8, in Bat's-wings, Nos. 0 to 10 inclusive.

## BRAY'S "ENAMEL" NON-REGULATOR.

These are similar burners in outward appearance to the Regulators, but somewhat less, and are without the interior regulating medium. Though they do not prevent the roaring and flickering, as the regulators do, they are excellent burners at the price charged. Our name is not stamped on these burners.

**THE SIZES** are, in Union-Jets and Slit-Unions, Nos. 0 to 8, and in Bat's wings, Nos. 0 to 10 inclusive.

### BRAY'S MARKET BURNERS.

These are Bat's-wings of unusually large size, and are admirably adapted for markets, butchers, and any purpose for which an immense flame is essential.

**THE SIZES ARE** Nos. 19 and 20.

All these burners are stamped "Bray's Market Burner," as shown in wood cut.

### The RAT'S-TAIL or ONE-HOLE BURNER.

This burner shoots out a straight jet, like a rat's tail, and is used to some extent in Scotland for illuminating purposes; and there, as elsewhere, for heating, cooking, pipe lighting, and other purposes.

**THE SIZES** kept in stock are Nos. 0 to 6 inclusive, but any other size is made to order.

**Every Description of Gas-Burner not herein mentioned made to order in "Enamel."**

# GEO. BRAY & CO., BLACKMAN LANE, LEEDS.

## ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

### SHOTT'S BOGHEAD.

### HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

### THRASHBUSH CANNEL

Yields 12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

### LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

### MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

### OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERBURN, FERGUSSON AND CO., 21, Lime Street, LONDON, E.C.

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GAS COAL.

**POPE & PEARSON, LIMITED,** have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12¾ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

---

## HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,594 cubic feet per ton of 14¼-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

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## HOLMSIDE GAS COALS.

*South Metropolitan Gaslight and Coke Company,*
*589, Old Kent Road, London, S.E.,*
*Oct.* 9, 1873.

At the request of Mr. Hedley, the owner of the Holmside Colliery, I have much pleasure in stating that, for about ten or twelve years past, this Company has taken at least half of its supply of Newcastle Coal from him. I can, therefore, confidently bear testimony to the good quality of the Holmside Coals, and consider they are equal to the best of the Newcastle Coals, in proof of which I may state that this year we are using those Coals exclusively, that the yield of Gas is from 9700 to 9800 feet per ton, and that the quality of the Gas, without any admixture of Cannel, is over 16 candles, as tested by the officer appointed by the Metropolitan Board of Works, using the London Gas Referees test.

The Coke is of excellent quality, and in quantity amounts to about 40 bushels from a ton of Coal.

The annual consumption of Coal amounts to about 75,000 tons.

GEORGE LIVESEY, Engineer and Secretary.

P.S.—I am at this date, Feb. 15, 1875, still using Holmside Coals as largely as ever, and am quite as well pleased with them as when I gave the above certificate.

GEORGE LIVESEY.

We are this year, 1878, using 80,000 tons of Holmside Coal. GEORGE LIVESEY.

FITTING OFFICE:
Address, 75, QUAYSIDE, NEWCASTLE-ON-TYNE.

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## M. BREMOND'S NAPHTHALINE PROCESS.

A negotiations respecting M. Brémond's patented process for preventing Deposits of

NAPHTHALINE

in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Compania Madrilena de Alumbrado y Calefaccion per Gas, MADRID, may be consulted upon all matters connected with Industry.

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## FERRAND DAVIES,

148 GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,
AGENT FOR
THOMAS BARR'S LESMAHAGOW MAIN CANNEL,
AND
NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.
Analyses and Quotations on application.

---

## WILSON CARTER AND PEARSON,
## GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:
TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

---

## GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,
35A, GREAT GEORGE STREET,
WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Invention
RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.
FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,
35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

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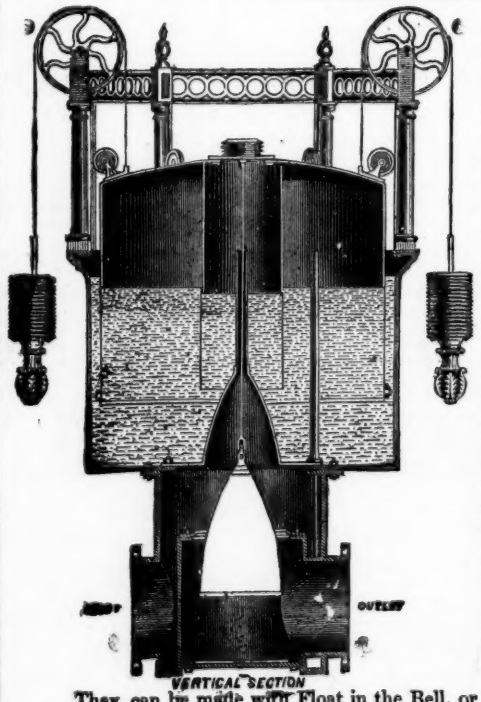
## J. & J. BRADDOCK,
## GLOBE METER-WORKS,
## OLDHAM,

Beg to submit to Gas Engineers their

## PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

# THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

**DODWORTH, BARNSLEY.**

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

## REAL OLD SILKSTONE GAS COAL.

**JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—**

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

**PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.**

---

**PARIS EXHIBITION, 1878.**

**THREE MEDALS**
AND
HONOURABLE MENTION
HAVE BEEN AWARDED TO
**JOSEPH CLIFF & SONS**
For their Various Exhibits, amongst which is a
**SILVER MEDAL**
FOR THEIR
PATENT MACHINE-MADE
**RETORTS AND FIRE-BRICKS,**
Being the Highest Honour given for this class.

Established

1795.

## JOSEPH CLIFF & SONS,

THE ORIGINAL
WORTLEY FIRE-BRICK WORKS,
**NEAR LEEDS,**
**London Wharf: No. 4. inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.**

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owingto their compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

---

## SAMUEL CUTLER & SONS,

**CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF**
**GASHOLDERS, TANKS, PURIFIERS,**
**SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.**

S. C. & Sons undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.
They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.
SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

**Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.**

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

**For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.**

---

# NEWTON, CHAMBERS, & CO.,

## THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

## CELEBRATED SILKSTONE GAS COALS.

**The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.**

**A recent extensive development of the Collieries enables us to offer increased supplies.**

**JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—**

*"Warrington Gaslight and Coke Company,*
*Offices, Mersey Street, Warrington, April 23, 1877.*

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

**Full particulars will be sent on application to us—address as above.**

# NEW PATENT WET GAS-METER,

## THE "RELIANCE,"

MANUFACTURED BY THE

## GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON.

---

## ALEXANDER WRIGHT & CO.,

MANUFACTURERS OF

## "WET" AND "DRY" GAS-METERS,

STATION-METERS, AND GOVERNORS.

METERS, BOXES, REGULATORS, AND ALL REQUISITES FOR PUBLIC LIGHTING.

TESTING APPARATUS for all purposes relating to Gas, &c.

MR. VERNON HARCOURT'S COLOUR TESTS,

Descriptive particulars, per post, 2d.

55, 55a, & 56, MILLBANK STREET, WESTMINSTER, LONDON, S.W.

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# R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW.

Manufacturers of

## CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges, Governors, Test Holders, &c., &c.

LONDON OFFICE:

6, LITTLE BUSH LANE, CANNON STREET, E.C.

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# IMPROVED HYDRAULIC CRANES,

Effecting a great saving in the cost of discharging Coals from Vessels, Barges, &c. Several of these Cranes, with the necessary power, are now being erected at the Beckton Gas-Works.

## DIRECT-ACTING HOISTS

For LIFTING RAILWAY WAGGONS to RETORT-HOUSE STAGEWAY; CAPSTANS for HAULING WAGGONS, &c.,

## HYDRAULIC APPARATUS for Lifting and Lowering Purifier-Covers.

Sixteen recently erected at Beckton, applied to Covers 30 feet square.

GAS AND WATER PIPES, ROOFING, BOILERS, &c.

## SULPHATE OF AMMONIA APPARATUS,

IN SUCCESSFUL OPERATION AT THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD GAS COMPANY.

For particulars, apply to

## JOHN ABBOT & CO., LIMITED,

2, SUFFOLK LANE, CANNON STREET, E.C., or PARK WORKS, GATESHEAD-ON-TYNE.


London: Printed by WALTER KING, for the Executors of the late WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street), and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, February 4, 1879.

THE

# JOURNAL OF GAS LIGHTING,

## WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXXIII. No. 822.] LONDON, FEBRUARY 11, 1879. [31ST YEAR.] Price 6d.

**GAS PURIFICATION**
BY
**OXIDE OF IRON.**

**COOKE BROS.,**
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
BLACKWALL, E.;
OFFICES:
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

**GENUINE TORBAY PAINT**
**And SPECIAL GASOMETER PAINT.**
SEVERAL PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*
Supplied, mixed ready for use, or in paste, as desired.
**TORBAY PAINT COMPANY.**
PROPRIETORS: STEVENS & CO.,
21, GREAT WINCHESTER STREET, LONDON.
WORKS: BRIXHAM, TORBAY.

**THOMAS PROUD,**
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
**LAYING MAINS**
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
**WOOD GRIDS**
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
**JOSEPH COWEN and CO.,**
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
JOS. COWEN & Co. are the only Manufacturers of FIRE-BRICKS and CLAY RETORTS at BLAYDON BURN.

**JOHN RUSSELL & CO.,**
LIMITED,
*Established at the commencement of Gas Lighting,*
MANUFACTURERS OF
**TUBES AND FITTINGS.**
**THREE PRIZE MEDALS,**
**Paris, 1878.**
HEAD LONDON OFFICE:
145, QUEEN VICTORIA STREET.
ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

**JOHN BENT & SON,**
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
**WET AND DRY GAS-METERS,**
LICENSEES AND MANUFACTURERS OF
HUNTS
**PATENT COMPENSATING METERS,**
STREET-LAMPS, &c., &c.
ESTABLISHED 1830.

**THOMAS PIGGOTT & CO.,**
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
**TELESCOPIC & SINGLE GASHOLDERS,**
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
*Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.*
SUGAR, SALTPETRE, AND ALL KINDS OF PANS.
*Roofs, Girders, and Bridges, and General Smith's Work.*
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
**"OTTO" GAS-ENGINE.**


See Page 182.

CROSSLEY BROTHERS,
**MANCHESTER AND LONDON.**

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
**LESMAHAGOW**
**CANNEL COAL.**
AGENT:
**JAMES M'KELVIE,**
HAYMARKET,
EDINBURGH.

# GEORGE GLOVER AND CO.,
**HAVE REMOVED TO MORE EXTENSIVE PREMISES,**
RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

**The want of gaslight, caused by the freezing of Wet Meters,** is a very general source of complaint, and it is acknowledged that all attempts to remedy the evil have proved futile.
The want of gaslight during the dark, foggy weather of mid-winter, when gas is most needful, is a source of great loss both to Gas Companies and the public. The convenience and economy of gaslight is so great, compared with any other artificial light; that there is no val d ground for believing that it can be supplanted, and, until coal becomes many times dearer than at present, it must remain the cheapest and most convenient source of light and heat. It is especially to be regretted, when Gas Companies are making every exertion to remove all just grounds of complaint, and, as far as possible, to consult the public convenience, that the annoyance caused by smoky and unsteady flames, or the total extinction of the lights, consequent on the freezing of wet meters, should induce the public to lend a ready ear to the fallacy of the electric light as a substitute for gas.
The destructive influence of the expansive force of water while freezing is familiarly known in the bursting of water-pipes during frost; but the injury to Wet Gas-Meters, although quite as real, being internal, is not so apparent. The internal parts of Meters which have been frozen are warped or ruptured, and they frequently receive further injury by the hasty and unskilful method of thawing them, which often melts the solder as well as the ice, unfastening the bearings or other parts of the Meter, thus admitting of gas passing unregistered. Meters, once frozen, should be thoroughly repaired, and, as soon as convenient, replaced by **properly made Dry Meters** which register correctly, and with the action of which the most intense frost does not interfere.
Of course water in Dry Meters or watches will freeze, but its accidental presence in either is very rare, and there is no excuse for its being in them. More than one parent has been startled by finding his little hopeful experimenting with his watch in the wash-hand basin, and more than one stupid person has been found pouring water into a Dry Meter. Water may also get into Dry Meters by placing them below the level of the main, and connecting the service pipe at the lower part of the main, allowing water to flow into the Meter. Another means of getting water into Dry Meters is by foolishly placing them in connection with Wet Meters, the vapour from which condenses in the Dry Meters. Some water may also find its way into Dry Meters when they have been put in the place of Wet Meters, before clearing the internal pipes and fittings from water that had been deposited in them by evaporation from the Wet Meters.
The presence of water in Dry Meters is so rare and exceptional that it is properly ignored. Water is a necessity in the Wet Meter; but is incompatible with the Dry Meter. No Gas Company or Consumer suffers loss or inconvenience from frozen water in Dry Meters; but it cannot be ignored that many Companies and thousands of Consumers have suffered, and are suffering, serious loss and inconvenience from the freezing of Wet Meters, and some few Companies are suffering from the use of so-called Self-Regulating Meters, through which all the gas can be got unregistered, by inclining the Meter forward either accidentally or with the intention to defraud—a subject deserving the serious attention of such Companies.

# LAMBERT BROTHERS, WALSALL.

## ALPHA TUBE & FITTING WORKS

Manufacturers of W. J. WARNER'S PATENT MARKET GAS STAND-PIPE.

Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.

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## ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

## GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

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## FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

---

# THOMAS ALLAN & SONS,

## IRONFOUNDERS.

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,

GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

## CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

„ 1½ to 10 „ STOCKTON.

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A LARGE STOCK KEPT, AND PRICES MODERATE.

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Freight to London, in the Stream, 10s. per ton from Stockton; 15s. from Glasgow.

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AGENTS FOR LONDON AND THE SOUTH OF ENGLAND:

THE THAMES BANK IRON COMPANY, UPPER GROUND STREET, LONDON, S.E.

# RICH. H. TAUNTON & HAYWARD,

MANUFACTURERS OF

## WROUGHT-IRON GAS, WATER, & STEAM TUBES & FITTINGS,

STAR TUBE WORKS, HENEAGE STREET, BIRMINGHAM.

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# MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

## IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

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# WEST'S GAS IMPROVEMENT COMPANY,

LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

## CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

---

# WILLEY & COMPANY,

GAS ENGINEERS,

## WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.

RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

☞ PLEASE NOTE THE ADDRESS—

GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

# GAS PURIFICATION
BY
## OXIDE OF IRON.
## GAS PURIFICATION & CHEMICAL Co., LIMITED,
**PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.**

JOHN WM. O'NEILL, Managing Director.

---

THE
## STANDARD WASHER AND SCRUBBER.
### [KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

**The Exposing of a large Amount of Effectually-wetted Surface (which is continually reproduced) to act upon the Gas.**
**Unerring Regularity in the Distribution of the Liquor.**
**Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.**
**Economy of Space, thus enabling the Apparatus to be protected from the Weather.**
**Economy of First Cost and of Maintenance.**
**It works without Pressure.**
**It is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.**

*Applications for Prices, &c., to be made to*

**Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.**

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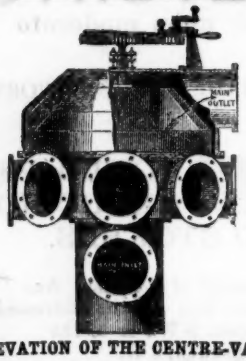
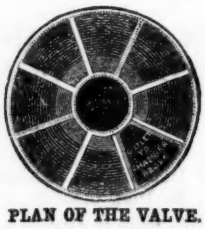


## C. & W. WALKERS'
## PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE. PLAN OF THE VALVE. PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

**MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.**

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## EDWARD COCKEY & SONS,
### GAS ENGINEERS, FROME SELWOOD,
MANUFACTURERS OF ALL DESCRIPTIONS OF
## APPARATUS CONNECTED WITH GAS-WORKS.
THE ORIGINAL PATENTEES AND MANUFACTURERS OF THE
## DRY-FACED VALVES
FOR PURIFIERS, GASHOLDERS, BYE-PASS, AND OTHER ARRANGEMENTS REQUIRING VALVES IN GAS-WORKS.

The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.

They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.

References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

**MANUFACTURERS ALSO OF SUPERIOR WOOD GRIDS FOR PURIFIERS, SCRUBBERS, &c.**

## GEORGE ORME & CO.,

**ATLAS METER-WORKS, OLDHAM,**

MANUFACTURERS OF

**WET AND DRY GAS-METERS,**

**STATION-METERS, GOVERNORS,**

**PRESSURE AND EXHAUST REGISTERS,**

LAMP-METERS IN CAST-IRON BOXES

**And every Description of Gas Apparatus.**

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## J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

**IRONFOUNDERS AND CONTRACTORS,**

**GOWTS BRIDGE WORKS,**

**LINCOLN.**

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

**REFERENCES TO 500 WORKS ALREADY ERECTED.**

N.B.—All Communications to be addressed to the FIRM ONLY.

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## J. & J. BRADDOCK,

GAS ENGINEERS,

**GLOBE METER-WORKS, OLDHAM,**

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

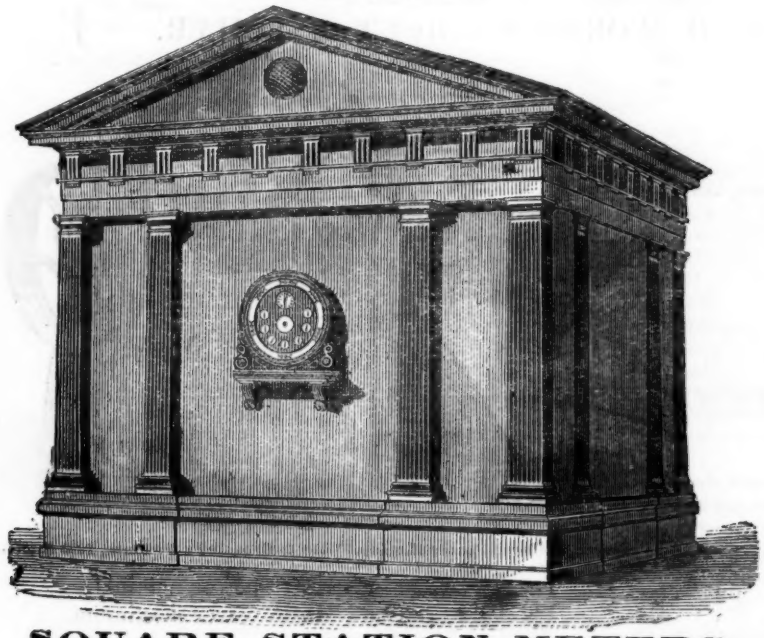
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

**ROUND STATION-METERS,**

ON CAST-IRON STANDS.



**SQUARE STATION-METERS,**

WITH PLANED JOINTS.

**GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.**

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

*Orders almost invariably despatched on the day of receipt.*

TERMS, &c. ON APPLICATION.

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## C. & W. WALKER'S

**WOOD PURIFIER SIEVES,**

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,
DONNINGTON, NEAR NEWPORT, SHROPSHIRE.
FINSBURY CIRCUS, LONDON.

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ESTABLISHED IN 1860.

**BENJAMIN CARPENTER,**

THE ORIGINAL MANUFACTURER OF THE IMPROVED

**WOOD SIEVES**

FOR

**GAS PURIFIERS & SCRUBBERS.**

PROVIDENCE WORKS,
22, HERMES STREET, PENTONVILLE ROAD
LONDON, N.

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**MOBBERLEY & PERRY,**

FIRE CLAY and BRICK WORKS,

STOURBRIDGE.

Proprietors of

BEST GLASS-HOUSE POT and CRUCIBLE CLAY.

Manufacturers for Home and Export.

GAS-RETORTS, GLASS-HOUSE FURNACE,
BLAST-FURNACE, TANK BRICKS, LUMPS, TILES,
And Every Description of Best Fire-Bricks.

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**JOHN ROMANS, C.E., F.G.S.E.,**

CONSULTING GAS ENGINEER

AND

**CANNEL COAL FACTOR,**

**30, St. Andrew Square, EDINBURGH.**

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

MR. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

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**GRIRDROD'S PATENT**

**PORTABLE PIPE SCREWING**

**MACHINE,**

For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

**W. H. BAILEY & CO.,**

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

LANCASHIRE.

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**Gold Medal Awarded, Paris Exhibition, 1878.**

## THOMAS TURTON AND SONS,

**SHEAF AND SPRING WORKS,**

**SHEFFIELD,**

MANUFACTURERS OF

**FILES OF BEST QUALITY**

**FOR ENGINEERS,**

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNERS
RATCHET BRACES, LIFTING-JACKS,
ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.

LONDON OFFICE:

**90. CANNON STREET, E.C.**

# R. W. WINFIELD AND CO.,

CAMBRIDGE STREET WORKS AND ROLLING MILLS,

## BIRMINGHAM.

The following Medals have been awarded:—

GRAND COUNCIL MEDAL, LONDON, 1851. MEDAL, LONDON, 1862. GOLD MEDAL, PARIS, 1867,

The only Gold Medal awarded for "Apparatus and Processes for Heating and Lighting" by the Imperial Commissioners

MEDAL FOR PROGRESS, VIENNA, 1873.

The following Medals were also awarded at Paris, 1878:—

GOLD MEDAL for Chandeliers and Gas-Fittings.

GOLD MEDAL (Rappel) for Metallic Bedsteads and Furniture.

GOLD MEDAL (Rappel) for Art Metal Work. BRONZE MEDAL for Tube Metal and Wire.

MANUFACTURERS OF BRASS AND COPPER SHEETS,

## TUBE AND WIRE,

ROLLED METALS, LOCOMOTIVE AND CONDENSER TUBES, CYLINDERS;

Ornamental, Taper, and Cased Tubes; Tin Tubes;

## GAS-FITTINGS, CHANDELIERS,

BRACKETS FOR HEATING AND LIGHTING;

## METALLIC BEDSTEADS.

Ecclesiastical and Mediæval Metal Workers.

## GENERAL BRASSFOUNDERS.

REGISTERED TRADE MARK:

R. W. W. & CO.

LONDON OFFICES & SHOW-ROOMS: 141, FLEET STREET, E.C.

THE

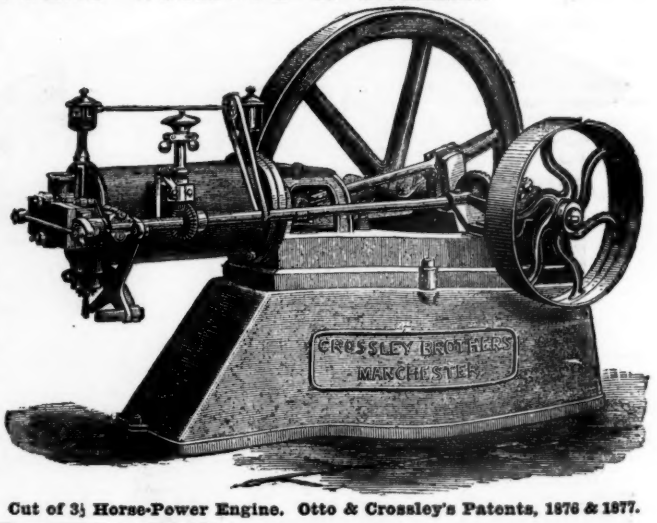
# New "OTTO" Silent Gas-Engine.

AN ENGINE WHICH WORKS WITHOUT A BOILER.

The principle of combustion in this Gas-Engine is ENTIRELY NEW. In it an explosion does not take place in the ordinary meaning of the term. A small part only of the charge is combustible, which on ignition serves to expand the remainder, thus avoiding shock and effecting great economy. The Engine is also alone in the peculiarity of igniting its charge at the *beginning* of the stroke, leaving the whole of the stroke for effecting expansion of the gases, instead of merely a fraction as in obsolete constructions.

This Engine has a SMALLER NUMBER of MOVING PARTS than any other Gas-Engine; or, indeed, than many steam-engines. It is almost as silent as a steam-engine, works with the same smoothness and regularity of speed, and has the immense additional advantages of always being ready to start at full power at once on the gas being lighted; and, by dispensing with the boiler, of avoiding the danger of explosion, increased rates for insurance, expensive attendance, and all the annoyance which the use of a boiler entails.

Where work is intermittent, trouble with a small steam-engine and boiler is at its maximum, but at its minimum with a Gas-Engine.




Cut of 3½ Horse-Power Engine. Otto & Crossley's Patents, 1876 & 1877.

Sizes at present offered . . . . 1, 2, 3½, and 8 Horse-power nominal.
Being equal to about . . . . 1½, 2½, 4, and 12 Horse-power maximum.

Cost of Gas, One Penny per hour per indicated Horse-power, at 4s. per 1000 cubic feet.

PRICES, LIST OF USERS, AND BOOK OF SEVENTY TESTIMONIALS, ETC., ON APPLICATION TO

## CROSSLEY BROTHERS,

WORKS: GREAT MARLBOROUGH STREET, MANCHESTER

LONDON WAREHOUSE: 116, QUEEN VICTORIA STREET, E.C.

SOLE ENGLISH AND COLONIAL MAKERS.

# TANGYE BROTHERS AND HOLMAN,

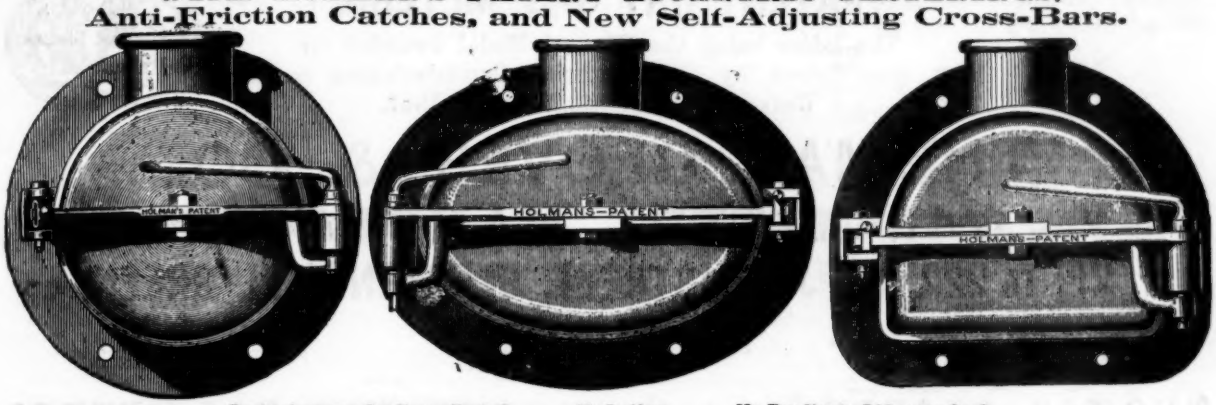
## CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

## SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

**WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,**

**Anti-Friction Catches, and New Self-Adjusting Cross-Bars.**




**Instantaneous Sealing effected. No Luting. No Duplicate Lids required.**
**Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.**

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

**T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.**

**D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—**

**The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.**
**And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland**

## HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

### TESTIMONIAL.

*The Gaslight and Coke Company,*
*9, Water Street, New Bridge Street,*
*Blackfriars, E.C., Feb. 27, 1875.*

MESSRS. TANGYE BROTHERS AND HOLMAN.

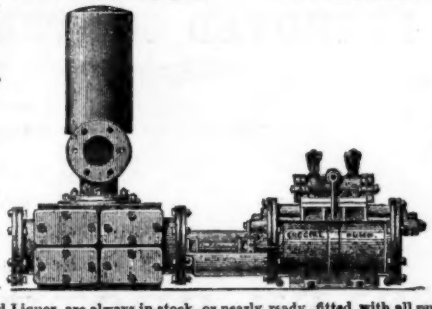
Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

**PRICES AND FULL PARTICULARS ON APPLICATION.**

## THE "SPECIAL" STEAM-PUMP.

| Diameter of Steam Cylinder. | Diameter of Water Cylinder. | Length of Stroke. | Gallons of Water per Hour, Approximate. | Reduced Prices. |
|---|---|---|---|---|
| 3 | 1½ | 9 | 450 | £16 |
| 4 | 2 | 9 | 815 | 18 |
| 5* | 2½ | 12 | 1,250* | 20 |
| 5* | 3 | 12 | 1,830* | 22 10 |
| 4 | 4 | 12 | 3,250 | 25 |
| 6* | 4 | 12 | 3,250* | 30 |
| 5 | 5 | 12 | 5,070 | 32 10 |
| 7* | 5 | 12 | 5,070* | 40 |
| 6 | 6 | 12 | 7,330 | 40 |
| 8* | 6 | 12 | 7,330* | 50 |
| 7 | 7 | 12 | 9,750 | 50 |
| 10* | 7 | 12 | 9,750* | 65 |



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

**TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS**
**HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.**

*FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.*

London, 1851 New York. 1853. Paris, 1855. London. 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
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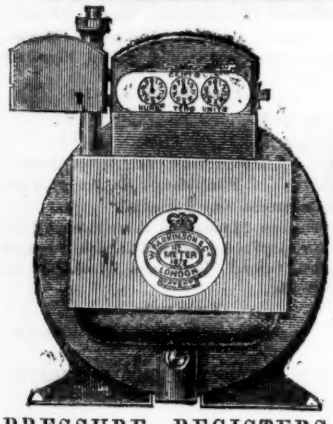

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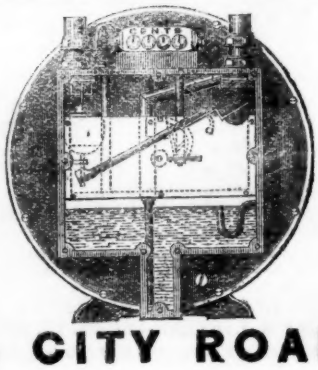

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## TO CORRESPONDENTS.

H. T.—*Received; but too late for this week.*

*Pressure on our space to-day compels us to hold over the reports of the Meetings of the Midland Association of Gas Managers, York United Gas Company, York New Water-Works Company, South Shields Gas Company, Newcastle-on-Tyne and Gateshead Gas Company; besides many other items of much interest.*

*No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.*


# THE JOURNAL OF GAS LIGHTING,

## WATER SUPPLY, & SANITARY IMPROVEMENT.

*TUESDAY, FEBRUARY* 11, 1879.


## Circular to Gas Companies.

We commence to-day the publication of the abstracts of the Gas Bills to be promoted in the present session. The Bills for incorporation of new Companies are few—too few, in fact, considering the number of Gas Companies who are without statutory powers. We have before remarked that this class of Bills has been crystallized into a definite form. General Acts and Standing Orders prescribe the exact shape they shall assume, and leave no choice to the Companies as to the provisions their Bills shall contain. There is, however, a novelty this year, which no Standing Order has yet provided for. Many of the Companies are going in for power to supply the electric light; and, indeed, any other means of illumination. Others are seeking authority to manufacture, sell, or let for hire, gas-engines, and all apparatus for cooking and heating, and gas-fittings in general. What will be said in Parliament to these innovations, we do not know; but we cannot help thinking that they will be regarded by many persons with grave suspicion. It will be thought that some of the new powers sought will open the door for Gas Companies to make larger profits; and this, many persons will deem an offence. It is curious to notice some of the Companies wishing to supply the electric light. There is Altrincham, for example, where the light is never likely to be required. This Bill is very specific in its wording. It tells us, for example, that "a wire is a "wire," whether it be carried on poles overhead, or buried in the ground beneath our feet; and, further, that the "term post means a "post." These definitions may assist some parliamentary draftsman, when applications to supply the electric light are more common than they are to-day. There is the Bromley Company applying for similar powers; but when the electric light will be required in their district no one can foretell. It will be seen that most of the Companies comply with Mr. Raikes's Standing Order, and insert auction clauses, and adopt the sliding scale in their Bills. One or two, however, try to shirk these provisions, but when they find themselves before Earl Redesdale or Mr. Raikes, they will probably be compelled to adopt them. New Companies, however, may escape. Incorporated Companies who are applying for further powers have, of course, to submit to these new regulations. There is a novelty in some of the proposals, as to the disposition of profits in excess of those required for standard dividends. Several Companies ask for power to set aside one per cent. to form an insurance-fund; and others desire to form a reserve-fund also. These are excellent proposals, but we think these ends might have been effected without special legislation. It is far better for a Gas Company, who have the sliding scale inflicted upon them, to set aside a reserve, so that they may be able to keep down the price of gas if difficult times arise.

The Imperial Continental Gas Association are going in for a wide extension of their limits. Hitherto their operations have been confined to the Continent of Europe; but, as their undertakings there are decreasing in number, they are looking out for "fresh fields and pastures new." They have selected the British Colonies as a proper field for exploitation, and we cannot help thinking that they have made a wise choice. We believe there are many cities and towns in Canada, New Zealand, and some of the Australian Colonies, which will receive their advances with open arms, but they will require some active, intelligent agents to pave the way for them. We have no doubt they will obtain their Act, and they have our best wishes that every success may attend them in their extended enterprise.

We have received the report of the Directors and the accounts of the Chartered Company, to be presented to the Proprietors at the half-yearly meeting on Friday next. Nothing can be more satisfactory than these documents. Notwithstanding the almost unprecedented depression in trade, the business of the Company continues to increase; but, unfortunately, on account of the bad sale of coke, and the falling off in the price of tar, the profits are not so large as they might have been. The sale of common and cannel gas brought £912,851. The sale of coke produced £134,032; tar fetched £36,571; and ammoniacal liquor brought £56,385. These, with other items, which need not now be mentioned, make the gross revenue £1,228,891. Against this must be placed the expenditure, amounting to £857,970, which shows a profit of £370,921. According to the net revenue account, the balance applicable for dividend on ordinary stock is £336,885, and as the money required for the half year's dividends, will be about £204,815, there remains a balance to be appropriated of £132,070. Since the sliding scale came into operation, the excess of profits has until now been wisely devoted to increasing the reserve-fund; but as this fund has reached the sum of £137,788, the Directors consider they are in a position to give the Shareholders an addition to the dividend, which the sliding scale justifies. Hence they propose for the past half year to divide five and a half per cent. The initial price for common gas, it must be remembered, is 3s. 9d. per thousand, and the Company now sell for 3s. 6d. As regards the manufacturing department, the accounts show that excellent management is exhibited. The yield of gas per ton of common coal was 10,519 feet. This, it must be remembered, is the average result obtained at all the stations of the Company; but we doubt whether, if we had details from each manufacturing establishment, we should find much difference.

To say the truth, we are getting tired of the electric light. To-day, again, our columns are—it would be ungracious to use the word encumbered, but we may say are occupied with two additional reports. One proceeds from a Committee of the Directors of the Chartered Company, and the other is extracted from the Inaugural Address of Mr. R. P. Spice to the Society of Engineers. The former document is, of course, intended to re-assure Shareholders. It professes to give the relative cost of the electric light and gas. The statements made are, no doubt, the results of carefully conducted experiments; but we must be excused for saying, we do not think them worth much. The simple fact is,

that it is too early to make comparisons of the cost of the two illuminants. To our mind, the most valuable part of the report is that which shows the comparative cost by the use of steam or a gas engine for furnishing the motive power. On this point, we accept the conclusions of the Committee without reservation. Mr. R. P. Spice gives, in his Inaugural Address, a neat and succinct account of the various systems of electric lighting now in use, and comes to the conclusion that not one of them, as yet devised, is at all likely to interfere with gas illumination.

Mr. J. F. Nicholson is still studying the subject of public electric lighting in Paris, and reports to us, in another column, that the Société Générale d'Electricité are certain to lose a large sum of money by the contract they have recently made with the Municipality of Paris. The Société have never paid a dividend, nor has any other Electric Lighting Company, that we are aware of; and they are not likely to do so for many years to come. The sanguine people who have sunk their money, must wait patiently until the happy days come. Enough, we cannot help thinking, has been said for the present about the light. It continues to push its way. It is about to be installed in the Reading Room at the British Museum, and in several other places. We shall presently hear of many more, but Shareholders in Gas Companies need not be alarmed until it reaches, as we may say, the domestic hearth.

We may allude here to what we have not mentioned before—the *désagréments* of the electric light. It is a well-established fact that nitric acid is produced. We can say nothing about this, or we shall have sulphur thrown in our teeth; nor can we say much about the heat produced; but that most disagreeable product, ozone, is given off, which, in ill-ventilated apartments, would produce much discomfort. Burned in large areas, no ill-effects are likely to be brought about by this active agent; but, as we have said, in small apartments much discomfort would be felt from its presence.

The London Gaslight Company are following in the steps of the Phœnix and the Chartered Companies, and offer the Chelsea Vestry and the Strand District Board of Works to put up Mr. Sugg's new lamps and burners in commanding situations, and also to supply the lamps and gas free, gratis, and for nothing. The Local Authorities have, of course, accepted the offer; but, naturally, some members were found to make objections.

The York United Gaslight Company held their half-yearly meeting on Thursday last, when the proceedings were of the usual satisfactory character. The suburbs of York are rapidly extending, and during the past six months the business of the Company has increased in a much larger proportion than usual. During this period the Company have laid 1191 yards of new mains in twelve new streets. This shows the progress that York is making, as well as the Company. We are very glad to see that coke has had a fairly ready sale, and that the Directors are doing all they can to promote its use for domestic purposes. The only thing which stands in the way of its more general employment, is that it requires breaking, and this necessitates a good deal of labour. The Directors of the York Company have hit upon the happy idea of employing steam for effecting this object. They will, doubtless, by the use of machinery, increase their stock of breeze; but they will be amply repaid by a largely increased sale of coke. Now that the electric light "scare" has passed, the Directors are seriously setting about improving their present works, and are thinking of commencing new ones in the summer. It is hardly necessary to add, that full dividends are paid, as usual, on all classes of shares.

The quarterly meeting of the Birmingham Town Council was held on the 4th inst., and was mainly occupied with the Annual Report of the Gas Committee. It goes without saying that, notwithstanding the depression in trade, the Corporation have had a very prosperous year's working—so prosperous, indeed, that we fear it will lead to many other Local Authorities plunging into the gas business. The net profit made during the year was £54,831 17s. 8d., apparently after the appropriation of £4104 11s. 4d. for the redemption of loans and annuities. The Committee recommended that the balance of profit be apportioned as follows:—£25,000 to the borough-fund; £7152 2s. to the reserve-fund, which now makes that fund full; and £22,679 15s. 8d. to the sinking-fund. All this must be highly satisfactory to the Corporation, and to every one, indeed, but the gas consumers, considered apart from the ratepayers. We are compelled to confess, however, that the former have still something to grumble at. The large contribution to the borough-fund out of profit, which benefits them remotely, is taken out of their pockets; and, although the price of gas is being lowered, the reductions are hardly proportionate. We read that the two reductions of threepence which the Corporation have made have benefited the consumers to the extent of £60,000; but, in the meantime, they are being overtaxed to the extent of £80,000. The adoption of the report was moved by Alderman Chamberlain, M.P., who, in doing so, delivered an exhaustive speech. So ample were the details, and so skilfully were the figures manipulated, that we could half believe that Mr. Chamberlain was bidding for the office of Chancellor of the Exchequer, when a Radical Administration is formed. We can only now give a few more figures, reserving any other observations until we have the actual accounts before us. Mr. Chamberlain claimed that the amalgamation of the Birmingham and the Birmingham and Staffordshire Companies has saved £10,000 in the cost of management, &c.; £12,000 by the Corporation being able to borrow at a lower rate of interest; £2000 by the abolition of Directors fees; £5000 by the overhauling of the mains, so saving leakage; and £1000 by alterations in old contracts. In conclusion, Mr. Chamberlain paid a well-merited tribute to the officers, both engineering and clerical. For the skill and energy of the former, we can answer, and we have no doubt the latter have been equally zealous in the performance of their duties.

We wonder whether the Corporation of Birmingham provide their Managers with broughams. The Corporation of Wigan have just bought one for the use of the Manager and Chairman of the Visiting Committee, but not without remonstrance from some of the Council, who seem to think that a "Whitechapel" would answer just as well as the more expensive vehicle they have purchased. They seem to have a curious way of managing the gas affairs at Wigan. There is a Gas Committee, from whom a certain number of members are elected to act as a Visiting Committee. These, it appears, actually do the work of management; the other members of the Committee knowing nothing of the business transacted until they meet to receive the report of the Visiting Committee. Now, as the latter are a majority of the whole Committee, they have it practically all their own way. Such an arrangement is not considered satisfactory by all, the minority thinking that the Visiting Committee should consist of the entire number of the Gas Committee. If a conveyance is to be provided for all these when they go their rounds, the Corporation had better at once invest in a four-horse drag, and do the thing respectably.

A curious condition of things exists in the Bromley Local Board. The Board had resolved to oppose the Gas Company's Bill in Parliament, and were proceeding to hold the necessary meetings under the Borough Funds Act, 1872. At the last meeting, which was intended to be final, so far as the Board were concerned, it was found that several members were Shareholders in the Gas Company, and could not vote in opposition to their own measure. It follows that, although there is a majority of the Board in favour of opposition, the absolute majority of the whole Board, which the Act requires, cannot be obtained. There is no way out of this fix, except by making an application to the Local Government Board, who will, no doubt, readily give permission to oppose.

A cantankerous lawyer at Torquay has sued the Torquay Gas Company for penalties for not keeping at the Company's office a Queen's Printer's copy of their Special Act, as required by the 45th and 46th sections of the Gas-Works Clauses Act, 1847. As it happens, the Company have two offices, for the transaction of different branches of their business. The one in Fleet Street seems to be a kind of inspector's office, where all complaints are received, and from which all notices are sent out. There was a copy of the Act there, but Mr. Carter, the complainant in the action, made it his business always to call at the Manager's dinner-time, when the Act, which is kept locked in a safe, could not be produced by the clerk. At the other office, the Secretary transacts his business, and the Directors meet; hence it must be considered the chief office. At this office Mr. Carter never applied, or he would at once have been shown the document he professedly wished to see. The case was heard at considerable length by the Torquay Magistrates, who dismissed it, deciding that each party should pay its own costs. Mr. Carter applied for a case for the Superior Courts; but probably nothing more will be heard of the matter.

In our advertising columns will be found an announcement of a publication, compiled by Mr. G. W. Stevenson, which we doubt not will prove of great utility to Counsel, Agents, Solicitors, and Witnesses engaged in promoting and opposing Bills in Parliament connected with gas and water undertakings. The publication covers about 130 pages of closely printed foolscap matter, and contains a mass of information of a precise character, which must have involved considerable labour and care in compiling. Only a limited number of copies have been printed, and, in order to prevent disappointment, we advise our readers to make early application for them.

A good and cheap book on fuel will be a great boon to many

engaged in engineering. A work of this kind has just been published.* It is a reissue of one of Weale's series, with large additions. It is confessedly a compilation, drawn chiefly from the works of Mr. C. W. Williams, A.I.C.E., and Mr. J. Symes Prideaux, and better authorities the Editor could not have gone to. To these are added valuable chapters by the Editor, D. Kinnear Clark, C.E., M.Inst.C.E., &c., &c., on recent practices in the combustion and economy of fuel—coal, coke, wood, peat, petroleum, &c. It is a book that we can strongly recommend to our readers.

## Water and Sanitary Notes.

A VALUABLE account of the quantity and quality of the water supplied to the Metropolis, by Dr. C. M. Tidy, will be found in another column. It rather staggers us, accustomed as we are to big figures, to find that 139,666,196 gallons of water were distributed daily to the Metropolis in the year 1878. As may be supposed, a large portion of this was wasted. Dr. Tidy ascribes the waste to the intermittent system of supply; but we are inclined to think it will be larger under the constant system, if the internal fittings be not rigidly looked after, or the flow be much contracted. Dr. Tidy, it is well known, fully approves of the quality of the water, and we agree with him and the Royal Commission of 1867, that the London supply is "satis-"factory, both as regards quantity and quality."

There are, as our readers may be aware, three processes in use for ascertaining the amount of organic impurity in water. We need not describe them in detail here, but just mention that one is the "combustion process," invented by Drs. Frankland and Armstrong, in which the dry residue obtained by the evaporation of a certain quantity of water is burnt to ascertain the amount of carbon and nitrogen present. The second is the "ammonia process" devised by Messrs. Wanklyn, Chapman, and Smith, in which a given quantity of water is distilled with strongly alkalined permanganate of potash, which converts organic matter into ammonia. The distillate is then collected, and the amount of ammonia present ascertained by "Nessler-"izing." The third is what Dr. Tidy calls the "oxygen process," which consists in adding to a certain quantity of water a known amount of permanganate of potash, and ascertaining the amount of oxygen taken up to oxidize the organic matter. In an elaborate paper recently presented to the Chemical Society, Dr. Tidy reviewed these three processes, and from a very large number of comparative experiments made by himself, he has been brought to the conclusion that permanganate affords the truest indication of the quantity of organic matter in a water. The paper was discussed at the meeting of the Chemical Society, last Thursday, and although two chemists can hardly be expected to agree as to the value of a process, Dr. Tidy's position was not strongly criticized. We hope soon to be able to publish the paper, when our readers will be in a position to judge of its value for themselves.

We are very sorry to hear complaints of a deficient supply and want of pressure of the water furnished by the East London Water Company. The Company's Special Act only requires them to send water to a height of forty feet; but it seems—if statements recently made by some members of a deputation to the Mile End District Board of Works are to be depended upon—that this pressure is rarely attained, and often, it is said, women residing on the top storeys of model buildings have to go to the basement to fetch their water. These buildings are, of course, much higher than forty feet, and ingenious architects have placed cisterns at the tops of the houses; but, of course, these cannot be filled without the use of force-pumps, which have not been provided. There are other complaints, as we have said, of deficiency of supply. We are certain that, after the attention of the Company has been called to the matter, everything that is possible will be done to remedy the alleged grievances.

Great complaints are also made of a want of water on the high service of Newcastle-on-Tyne. It is alleged that the inhabitants on this service are occasionally without water for a fortnight or three weeks at a time, and have to fetch all they want from a lower level. We hope this state of things will be remedied when the new works of the Company are brought into use.

The Annual Report of the Manchester Corporation Water-Works Committee has just been presented to the Council. It shows a very satisfactory state of things, while, at the same time, it sets out the largely increasing wants of the city. During the past year, fifteen miles of iron piping have been laid in extensions; and connections have been made to 7276 additional houses and premises, by means of six and a quarter miles of lead piping. The service in Manchester is constant, and there is, no doubt, a large amount of waste, which the Committee are doing their best to prevent, by making a careful inspection of internal fittings. The great increase of consumption during the past twelve months plainly indicates that, before many years are over, a large addition to the water service will be required, and the supply which can be obtained from Thirlmere will be none too great for the future wants of the city and suburbs. Opposition to the Corporation Bill to carry out their new scheme, appears to be passing away on the part of the large towns. Wigan opposes, but merely to obtain a *locus standi*; for what purpose, no one seems to know. Preston has resolved to withdraw, after what is called an animated discussion in the Council, conducted in true Corporation fashion. "I know nothing of the resolution," a worthy Alderman is reported to have said; "but I disagree "with it."

At a town's meeting in Cardiff, a resolution to promote in Parliament the Bill for the purchase by the Corporation of the Cardiff Water-Works was unanimously adopted. As no opposition from any outside quarter is likely to be raised, we may take it that the water-works have now practically passed from the hands of the Company.

The Norwich Water-Works Company have recently held their half-yearly meeting. The report shows that the Company continue their prosperous course. The city naturally increases in population, and large additions are required to be made to the works. For these extensions, plans have been prepared, and the works will shortly be commenced. The Company pay a dividend of six per cent., and we hope, when the additional works are brought into operation, a larger dividend will be possible.

The York New Water-Works Company are as prosperous as their brother, the Gas Company; being able again to pay their increased dividend of eight per cent. Extensions are required, as a matter of course, and these are in progress. The new works, to meet the increased demand, are now being pushed forward as rapidly as circumstances will allow.

Many persons have doubted whether sewage could be effectually filtered in frosty weather; but Mr. J. Bailey Denton sets all doubts at rest by writing his experience, obtained at a recent visit to the Barnsley sewage farm during the late very severe weather. The sewage has necessarily a considerably higher temperature than the water frozen in the pores of the filter-bed; hence, on the arrival of the sewage, an immediate thaw takes place, and the work of filtration goes on as in summer. Mr. Denton has not given us an account of what happens on a sewage farm in which a good deal of water lies in the furrows, and in which thick ice may be formed. The sewage arrives on this spot at a much lower temperature than it does on the intermittent filtration-beds, and will have a great deal of work to do in thawing the ice over a large area. On such farms, we believe, a good deal of difficulty has been experienced in keeping the furrows open.

A deputation, representing ninety-five per cent. of the alkali manufacturers, recently waited upon Mr. Sclater-Booth, and urged that, while they submitted with readiness to the restrictions imposed upon them by the Alkali Acts, they considered themselves hardly done by because similar restrictions were not imposed on other manufacturers, the acid emanations from whose works were more destructive than those issuing from alkali works. There is much reason in this, and, notwithstanding the general objections we have to inspectors and inspection, we should be glad to see all manufactures which give off noxious vapours placed under supervision. We entirely approve of a suggestion made by the deputation, that the inspectors should be appointed by the Central Board, and not by the Local Authorities. The appointments under the first Alkali Act were exceptionally good; hence the successful working of the measure. Of course, as regards future legislation, the deputation received only an evasive answer from Mr. Sclater-Booth.

THE REGISTRAR-GENERALSHIP.—In reference to the paragraph which appeared on this subject, in our last week's "Water and Sanitary Notes," we have since learned that the retirement of Major Graham from the post of Registrar-General will take place at the close of the present year. We also learn that Dr. William Farr, who for a period of forty years has been the chief of the Statistical Department of the General Register Office, is still in sufficient health and vigour to occupy the post to be vacated by Major Graham, should he receive the appointment. As we remarked last week, there is no man living who could take precedence of Dr. Farr in familiarity with the duties of the office, and there can be no doubt that the department owes its efficiency mainly to his energy and ability. It is to be hoped that the appointment will not be given to an outsider, possessing no special knowledge of the work which has to be performed. It is also satisfactory to find that, if Dr. Farr were appointed as Registrar-General, there would be a reduction in the annual charge in respect to salaries, without any diminution in the efficiency of the department.

* "Fuel: Its Combustion and Economy." London: Crosby Lockwood and Co. 1879.

## UNDERGROUND WATERS.

To "dig a well" is deemed a meritorious act in Oriental climes. Here in England a great public service is rendered when people are told where to dig. It is not every well that yields sweet water, and it is not every community which gets the water it ought to have. It is quite possible for one place to rob another even in this matter of water supply, and it is especially likely for small towns to have their natural water supply appropriated by larger ones. There is water enough for all; but there is a kind of scramble going on, which points to the necessity of a little wholesome control. The letter of the Prince of Wales to the Society of Arts last year, raised the question as to how far some large and comprehensive scheme of a national character, adapted to the varying specialities and wants of districts, might turn to account the great natural resources of the kingdom in respect to water, so as to render them available, not merely for the benefit of a few large centres of population, but for the general body of the nation at large. Despite all the science of the age, "blundering and plundering" of a certain kind may be said to characterize many of the schemes for the water supply of towns. Engineering skill may not be deficient; but administrative ability and geological science occasionally appear to be wanting. There is also the temptation to take the readiest and cheapest way towards gaining a supply of water, regardless of ulterior considerations. Reference has already been made in our columns to a passage in the third report of the Committee of the British Association on the Circulation of Underground Waters, which gives two instances of the blundering process. Colliery shafts sunk in the New Red Sandstone and Permian formations near Pemberton and Ashton-in-Makerfield yield an almost inexhaustible supply of pure water. Yet each of these places has obtained an Act of Parliament to take a supply from the surface of cultivated land, thus adopting a suspicious description of water for the use of the inhabitants, and neglecting the unexceptionable supply close at hand. Much opposition was encountered in getting the authority of Parliament for these projects, and great expense was incurred; while in one case—that of Ashton-in-Makerfield—the surface water can only be made available by means of constant pumping. To make matters worse, Pemberton has constructed a reservoir which fails to hold water, and is going to Parliament in the ensuing session for another Act, in order to take water from a different source. By the time the inhabitants get their supply, the expenditure for power to execute works, and for the works themselves, will have been enormous.

According to the third report of the British Association Committee, not less than ten thousand square miles of area are occupied in England by the New Red Sandstone and Permian formations, which absorb at least ten inches of rainfall annually. This area is a fertile source of shallow wells, both the sandstone and the overlying drift of sand and gravel forming an excellent water-bearing stratum. But it unfortunately happens that, although these shallow wells yield clear and palatable water, they are almost valueless as a source of domestic supply, being affected by the numerous and potent sources of pollution by which they are surrounded. The investigations of the Underground Waters Committee show that this state of things admits of complete amendment. By sinking these wells to a greater depth, and taking care to exclude the polluted water at and near the surface, a perfectly wholesome supply may be obtained. The Committee have carefully investigated the data on this subject, and show that there is a supply to be obtained from the New Red Sandstone and Permian of England of not less than 3600 million gallons daily. In quality, this water is remarkably free from organic impurity, the natural filtration through the rock having the effect of oxidizing the polluting compounds prevalent at the surface. The hardness of the water is not to be apprehended as a source of danger to the public health, if we may judge from the comparative mortality of hard-water and soft-water districts. But polluted shallow wells continue to furnish the drinking supply of many millions of the people. Through increase of population and the growth of manufacturing requirements, the quantity of water annually consumed in England is steadily augmenting. As the number of available sources for meeting the demand is necessarily limited, the struggle to get possession of suitable water-bearing areas, especially adjoining the more densely-crowded centres, becomes increasingly severe, giving rise to an enlarged outlay in the shape of parliamentary and other preliminary expenses. "Rival town-"ships," it is stated, "after severe competition, obtain the "whole of the water rights of a district, to the exclusion of those "who, from apathy, ignorance, or want of funds, neglect to "claim a portion of the supply naturally belonging to them." The Committee complain that the Local Government Board and Parliamentary authorities go no farther than to ascertain whether any water scheme laid before them is likely to fulfil the particular objects proposed, and the investigators have no means of judging whether it is the best scheme, or whether it will interfere with the interests of other districts which may not be represented. The abundance of water in the country shows that there is no need why one region should be invaded for the exclusive benefit of another. If a large city must of necessity reach out to a great distance for its water supply, it ought to share the treasure with those who, by virtue of their location, have a prior claim upon it.

The fourth report of the British Association Committee on Underground Waters has reference to the Jurassic, as well as the Permian and New Red Sandstone formations. Mr. C. E. De Rance, who is the Secretary to the Committee, has prepared a table showing the area of the geological formations in each river basin, from which it appears that the Permian and Trias have an area of 8645 square miles; the Oolite, 6671; and the Hastings Sands, together with the Greensand and Chalk, 11,371; thus making a total of 26,687 square miles yielding subterranean waters. This is what may be called an area of wells. Under the head of "Moor-"land Waters" we have an area suited for gravitation schemes, the water being retained at the surface. The report gives an area of 11,455 square miles for the Granite, Metamorphic Rocks, Cambrian, Silurian, and Devonian; and 10,080 for the Carboniferous Rocks, *minus* the Carboniferous Limestone; the total in the second list being thus 21,535 square miles. It is reckoned as probable that four-fifths of the area of permeable rocks in the first list would yield unpolluted water, and would receive into their mass not less than from ten to fifteen inches annually. If six inches only were yielded up in wells, this would give no less than 240,000 gallons per day for each square mile of surface, or a total for England and Wales far in excess of that required for drinking and manufacturing purposes. In respect to the moorland area, the Committee observe that it is somewhat out of their province; but they cannot refrain from calling attention to the costly legislation incurred by all extensive gravitation schemes, whether the supply be taken from natural lakes, as in the proposed Thirlmere scheme for Manchester, or from artificial reservoirs, as the proposed supply for Liverpool from the sources of the Severn. Attention is directed to the fact, that the Select Committee on the Manchester Corporation Water Bill recognized the importance of the opinion expressed by the Duke of Richmond's Commission in 1868-69:—"It appears to us that the Legis-"lature should always jealously watch any proposal for a town "taking water from a gathering-ground at a distance from it, lest "by so doing it may deprive other places nearer to such gathering-"ground of their more natural source of supply." It is admitted that cases doubtless exist, to meet which it will be necessary to go to these distant sources, especially where the populations have been accustomed to soft water and it would be dangerous to suddenly change the character of the supply. But in the Midland districts, lying on the Secondary Rocks, the inhabitants are accustomed to hard water, concerning the quality of which the Committee say they have proved the supply might be made, by an efficient system of well-boring, all that could be desired.

In a paper written not long ago by Mr. De Rance, "On the "Palæozoic and Secondary Rocks of England, as a Source of "Water Supply for Towns and Districts," some curious facts are stated as to the presence of sulphate of lime in the water used by the Burton brewers. This ingredient is believed to give to the Burton water its pre-eminence in the manufacture of beer. Mr. Molyneux, who is a member of the Underground Waters Committee, considers that the large proportion of calcareous ingredients in the Burton supply, amounting to seventy grains per gallon, is due to the water dissolving the gypsum of the Keuper marls of Needwood Forest, from whence it flows down the dip planes of the strata to the Burton Valley fault, up which it rises, and is tapped by the artesian borings belonging to the breweries. Herr Griess has made some interesting calculations on this subject, by which it appears that the gypsum derived from the water used in brewing a thousand gallons of ale would be 250 lbs. Assuming that Burton produces 1,400,000 barrels of ale in a year, it is reckoned that no less than 350,000 lbs. of gypsum are swallowed annually by the consumers of this pleasant beverage. The total quantity of water used in the various operations of brewing, and derived from the Burton Valley gravels, is estimated to contain probably not less than three times the foregoing weight of gypsum, or as much as 1,050,000 lbs., which Mr. Molyneux considers will not represent one-tenth the amount of gypsum annually carried to the sea by the agency of surface streams. It is believed that many local subsidences which have taken place in various parts of Needwood Forest are due to the fracture and sinking of gypsum beds

abraded by underground streams. According to this view of the case, the customers of Messrs. Bass, Allsopp, Salt, and others, are drinking a quantity of gypsum which renders them in part responsible for some little disturbance of the earth's crust. It is a fact of some interest, as showing the practical value of geological research, even where it might be thought wholly out of court, that a sagacious geologist, reasoning on the foregoing facts, suggested to a firm of brewers in Preston that they could possibly compete with Burton by using a judicious admixture of gypsum. The suggestion was adopted, and it is said that the beer has been all the better for it. Hence "Burton ale" need no longer be a mere local product.

In an appendix to the fourth report of the Underground Waters Committee, is an account by Mr. Isaac Roberts of some experiments on the filtration of sea water through Triassic sandstone. In the town of Liverpool, several million gallons of water are pumped daily out of wells made in the pebble beds of the Bunter sandstone. But, in the opinion of Mr. Roberts, the local and geological circumstances are such as to render it difficult to explain where the water comes from—that is to say, very little of the water could come from surface percolation, and the formation itself, according to the view taken by Mr. Roberts, does not appear capable of furnishing the supply. A few years ago, this gentleman suggested that most of the water drawn from these wells must flow from the Liverpool Docks and the River Mersey, by passing through the intervening mass of rock, and that the sandstone rock must either filter, or chemically neutralize the salts held in solution in sea water. Analyses of water drawn from several wells contiguous to the Mersey at Liverpool show a gradual increase in the proportion of salt—a result favourable to the idea that sea water is being filtered through a medium which is gradually becoming charged with the extracted salts. We have here a reversal of the Burton experience. In that instance there is abstraction from the underground strata, whereas in this instance there is a process of addition. Actual experiments conducted by Mr. Roberts show that Bunter sandstone does really remove the chlorides from sea water, but the power is gradually lost as the sandstone becomes impregnated. Thus 93½ ounces of sea water were passed through two cubic feet of sandstone, the liquid being applied in fourteen instalments. The first instalment consisted of 3½ ounces, and from this quantity as much as 80·8 per cent. of the chlorides was removed. The reduction went on in a diminishing ratio, until at last the two cubic feet of sandstone became very nearly inoperative as filters, the quantity of chlorides removed from the fourteenth instalment being only 8·51 per cent. The sandstone employed in the experiment consisted of two cubes, each containing one foot. One of these cubes was subsequently used for a contrary process —that is to say, spring water was passed through it in order to wash out the chlorides which had been obtained from the sea water. It required 101 ounces of the fresh liquid before the water came out with no greater degree of saltness than that of the sea. When 193 ounces had been passed through, the water came out with only a trace of the chlorides. It is therefore considered that the filtering action of the sandstone is purely mechanical or molecular, and is not a chemical process.

As affecting the water supply of Liverpool, it is important to observe that the wells which appear to be in connection with the river are situated very near its banks. They may, in fact, be described as situated within half a mile of the stream, and some of them considerably within that distance. Appended to the third report of the Underground Waters Committee is a paper, by Mr. W. T. Mellard Reade, "On the South Lancashire "Wells." Reference is therein made to the investigations of Dr. Campbell Brown, the Borough Analyst for Liverpool, as to the character of the water obtained from the Liverpool wells. Comparing the analyses of Dr. Brown with those given in a report by Robert Stephenson in 1850, Mr. Reade says: "It is "impossible not to be struck with the fact that the Corporation "wells at Bootle and Windsor are now yielding water of almost "identical quality with that supplied in 1850, although there "have been many intermediate fluctuations." Mr. Reade further says: "I quite agree with Dr. Brown also, that there is very "little, if any, percolation of sea water into the Corporation "wells, and I consider his arguments are conclusive on that "point." But Mr. Reade admits at the same time that some wells in Liverpool are affected by the sea. He says concerning this: "It is naturally what we should expect; but each case "must be taken by its own evidences, and the fact remains that "though the mean level of the water in the Bootle well was "about twenty feet below low-water mark in 1876, and its dis-"tance from the sea is under a mile, with the dip of the rocks "from the sea towards it, yet no sea water enters the well." If we adopt the view that there are fissures in the sandstone rock, which convey water from a distance like so many underground conduits, we are not obliged to depend solely on the theory of filtration from the Mersey and the sea, as the source of the Liverpool water supply. Mr. Reade considers it to be evident that the rain water is absorbed generally by the sandstone rock at the surface, that it percolates very gradually to underground fissures, traverses planes of bedding and jointing, and so circulates until it is drawn off by the well.

Such are some of the facts and inferences to be found in the reports we have cited, and we shall look with interest for further results connected with the investigations of the Committee appointed by the British Association. The scientific collation of facts relative to the water supply is one thing especially wanted, in order to prepare the way for a better administration of the national resources in this particular.

## GAS BILLS FOR 1879.

TWENTY-FIVE Bills relating to gas undertakings have been presented to Parliament for consideration in the present session. Six of these are to incorporate Companies hitherto without statutory powers. They are as under:—

The *Houghton-le-Spring District Gas Bill* is to incorporate a company, with power to purchase the Houghton Gas-Works. The capital of the Company is to be £20,000, in £10 shares, and power is sought to borrow £5000, but no part of this sum is to be raised until the whole of the capital has been issued and accepted, and one-half of it paid up. It is proposed to supply gas of fourteen-candle power, tested by Sugg's "London" Argand burner, No. 1. The price of gas is not to exceed 5s. per thousand within the township of Houghton-le-Spring, and 5s. 6d. beyond. The Company do not propose to adopt the sliding scale and auction clauses.

The *Knutsford Light and Water Bill*, so far as gas is concerned, is promoted to incorporate the Knutsford Light and Water Company, with power to supply gas or other artificial light within their present district. The "lighting capital" of the Company is not to exceed £11,000, and any new shares that may be issued are to be of the value of £5; that is, if Earl Redesdale consents. The auction clauses and sliding scale are introduced, and the standard price is to be according to the quantity of gas supplied per annum by the Company, thus giving them a double sliding-scale. When that quantity does not exceed four million cubic feet, the price is to be 7s. per thousand; but if it should ever exceed ten millions, the initial price is to be reduced to 4s. 6d. The quality of the gas to be supplied is to be of fourteen candles illuminating power, tested by Sugg's "London" burner, No. 1.

The *Morecambe Gas Bill* is to incorporate the Morecambe Gas and Light Company. The original capital of the Company was £2000, in £5 shares, and this has been twice added to; making the total amount of the present capital £24,000. By this Bill power is sought to raise an additional £24,000, in £10 shares. The first-named amount is to be deemed the original capital, and is to be converted into £10 shares or stock. The new capital is to be raised in £10 shares, which are to be disposed of by auction. The dividend on the original capital is, of course, to be ten per cent., and that on the new, seven per cent.; both being subject to the sliding scale. The gas supplied is to have an illuminating power of fourteen candles, tested by the usual burner. The standard price to be charged by the Company is to be 5s. 6d. per thousand cubic feet, subject, as we have said, to the sliding scale. The Bill seeks to obtain power for the Company to supply all kinds of artificial light, including the electric.

The *Queenstown Gas Bill* is to incorporate the Queenstown Gas Company. The Company was formed in 1856 with a capital of £10,000, all of which has been issued, and £9000 paid up and expended. They have also borrowed £5000, of which £4600 still remains owing. The increasing demands for gas in Queenstown require an extension of the works, so by this Bill the Company seek power to raise additional capital to the amount of £12,000. If the Bill should pass, the capital of the Company will be divided into three classes—viz., the original capital of £10,000, which will be entitled to ten per cent.; the capitalized profits which have been expended on works, £3000, on which five per cent. may be paid; and the additional capital to be raised under the sanction of the present Bill, £12,000, which will be entitled to seven per cent. These are the standard rates; but as the sliding scale is introduced, they may be varied. The new shares are, of course, to be offered for sale by auction or tender. The standard price to be charged for gas is to be 6s. per thousand, and the illuminating power fourteen candles, tested by the No. 1 "London" burner. The Company seek power to supply light obtained by electricity or by any other means, and to manufacture and sell all apparatus necessary for the purpose.

The *Westgate and Birchington Gas and Water Bill* is to incorporate a company formed to take over the undertakings at present belonging to Mr. E. F. Davis. The capital proposed is £45,000, to be divided into two classes, A and B; the former representing £20,000, deemed fully paid up, the latter to consist of 2500 shares of £10 each. This being a new company, it is not proposed to introduce auction clauses or the sliding scale. The maximum price of gas is not to exceed 6s. per thousand, and the illuminating power is to be fourteen candles, as tested by the usual burner. For the rest, all the powers generally granted to a Gas Company are sought.

The *Wisbech Gas Bill* is to incorporate a company formed in 1858, with a nominal capital of £10,000, the whole of which has been raised and expended, and the Company have also expended, in extensions and improvements, considerable sums out of profits, and it is estimated that the works are now worth more than £25,000. The Company seek authority to raise additional capital to the amount of £8000, which may be raised by ordinary or preference shares at the customary rates of dividend. The usual borrowing powers are asked. By this Bill it is proposed to capitalize only £5000 of the expended profits. The new shares are, of course, to be sold by auction. The standard rates of dividend on the additional capital proposed are eight per cent. on ordinary, and 6 per cent. on preference. These rates may, of course, be varied by the sliding scale. The standard price of gas proposed is 5s. per thousand, and the quality is to be fourteen candles, tested by the usual burner. Power is sought to form a reserve-fund out of profits in excess of those required to pay the standard rates of dividend. Of course, the Wisbech Company look forward to lighting the town by electricity, or some other means of illumination, so they take Time by the forelock, and pray for all the necessary powers to carry out their designs, if it should be thought desirable or possible.

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There are fifteen Bills promoted to obtain additional powers, by Gas Companies already incorporated. They are as follows:—

The *Altrincham Gas Bill* is to enable the Altrincham Gas Company to extend their limits, and empower them to supply means of illumination other than by gas. The object of the Bill seems to us to be mainly the acquisition of authority to supply the electric light, and to obtain power to manufacture, sell, and let on hire, gas-engines, meters, cooking and heating stoves, &c. No new capital is asked for, and the Bill, for the rest, seeks to supply some omissions in this Company's Act of 1872. There is one noticeable provision, which is, that the charge for gas consumed in houses occupied by servants, may be recovered from their employers. It is now proposed to supply fourteen-candle gas, at the usual pressures.

The *Brighton and Hove Gas Bill* is to authorize the Brighton and Hove General Gas Company, first of all, to supply light other than by gas, and then to extend their works, for which purpose they desire to raise additional capital. Besides the extension of the gas-works proper, they wish to erect works to preserve their present property from the influx of the sea, and to construct wharves on the eastern side of Shoreham Harbour. For all these works a large sum of money will be required, and the Company accordingly seek power to raise an additional £250,000, carrying the usual borrowing powers, the standard dividends on which are limited to seven per cent., if issued as ordinary, and six per cent. for preference. The new capital is necessarily to be sold by public auction, and shares not disposed of may be offered to existing Shareholders. The Company, of course, go in for power to supply the electric, and whatever other light may turn up; and also to sell and let for hire, or otherwise deal in, and supply and fix, set up, alter, remove, and refix, gas and other apparatus, engines, stoves, fittings, pipes, and other appliances for the cooking of food, and the warming and lighting of houses.

The *Bromley Gas Bill* is to enable the Bromley Gas Consumers Company to raise additional capital to the amount of £100,000, carrying the usual borrowing powers. The original capital of the Company was £87,500, all of which has been raised and expended. The new shares are, of course, to be sold by public auction, and need not be paid for until twelve months from the day of sale have elapsed. Those undisposed of may be offered to existing shareholders. A shareholder, bidding the same amount offered by a non-shareholder, is to be declared the purchaser. The Bill provides that £50,000 of the original capital is to be entitled to a dividend of ten per cent., and the remainder, with the additional capital, to seven per cent. per annum. The standard price of gas is to be 5s. 2d. per thousand, subject to the sliding scale. The quality of gas supplied is to be fourteen candles, tested by Sugg's Argand No. 1. The Bill, we understand, will be opposed by a section of the ratepayers.

The *Bury St. Edmund's Gas Bill* is to enable the Bury St. Edmund's Gas Company to raise further capital. Their present capital is £30,000, which is very nearly paid up and expended. Power is now sought to raise an additional £20,000, with borrowing power to the extent of £6600. To this may be added the residue of the sum authorized to be borrowed under their Act of 1859. It is proposed that the issue of new capital shall be limited to £8000 the year following the passing of the Bill, and £4000 in any subsequent year. If the whole amount of capital so authorized be not issued one year, the difference may be added in any succeeding year. The dividends on the new capital are limited to seven and six per cent., according as it is issued as ordinary or preference. The shares are, of course, to be sold by auction, and premiums devoted as usual. Power is sought to set apart profits in excess of those required to pay standard dividends, to form, first, an insurance, and then a reserve-fund. The standard price of gas is to be 5s. 6d., and, subject to the sliding scale, the dividends will be as above. The gas to be supplied is to have the illuminating power of fourteen candles, tested by Sugg's "London" burner, No. 1.

The *Glossop Gas Bill* is to authorize the Glossop Gas Company to raise further capital. By an Act passed in 1845, they were empowered to raise a capital of £6000, and to borrow £4000. In 1855, they obtained power to raise an additional £18,000, with borrowing power to the extent of £7000. By the Bill, power is sought to raise additional capital to the amount of £40,000, carrying the usual borrowing powers. The new shares are, of course, to be sold by auction, and the premiums applied as usual. The dividends on the new capital are limited to six or seven per cent., according as it is issued as preference or ordinary. The quality of the gas to be supplied is to be fourteen candles, tested by the new "London" burner.

The *Ilkley Gas Bill* is to enable the Ilkley Gas Company to raise further capital, and to supply the electric light. The present capital of the Company is £12,100, and they have borrowed £3000, all of which has been expended. By this Bill, the Company seek power to raise additional capital to the amount of £25,000, carrying the customary borrowing power. The new capital is to be sold by auction, and the premiums applied as usual. Any shares remaining unsold may be offered to shareholders. The dividends on the additional capital are limited to seven or six per cent., according as it is raised, but subject to the sliding scale. The standard price of the gas is to be 4s. 6d. per thousand feet. The gas is to have the illuminating power of fourteen candles, tested by the usual burner. A little difference is proposed in the pressure usually prescribed—viz., five-tenths and eight-tenths within the customary hours.

The *Imperial Continental Gas Association Bill* is to obtain authorization to supply the electric or any light other than gas, and, as we may say, to extend their limits by empowering them to supply cities, towns, places, and persons in any British colony or dependency with gas or any other means of lighting.

*(To be continued.)*

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## A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

### CLXVIII.

### THE TREATMENT OF RESIDUAL PRODUCTS.

#### Distillation of Coal Tar.

There are three principal systems employed in the distillation of gas tar, which may be described as the English, the Scotch, and the French. This designation is not absolutely accurate, because few tar distillers work in exactly the same way, and some use a composite method which includes one or more processes, borrowed from what may be termed the other schools of tar distilling.

These three systems may be thus defined, the qualification in the last sentence being understood:—

The English system, as carried out near London, consists in distilling the tar with the naked fire.

The Scotch system consists in distilling the "green tar" in a current of steam up to a certain point, then transferring the "boiled tar" to other stills, and finishing the operation over a naked fire.

In the French system, the tar is de-hydrated—*i.e.*, the ammoniacal liquor is distilled off at a comparatively low temperature in one vessel, and the tar, having been transferred to another, is distilled with the fire.

It will be seen, therefore, that the variation in the methods only affects the first stage of the operation.

#### The English System.

The tar and ammoniacal liquor are first allowed to stand in tanks, to permit of their separation into two layers. The tar, being the heavier, sinks to the bottom, and can, therefore, be pumped into the still comparatively free from water. The less water is present in the tar at this stage the better, because tar containing ammoniacal water is, if not heated carefully, very liable to boil over.

A form of still commonly used is seen in elevation in fig. 6. The

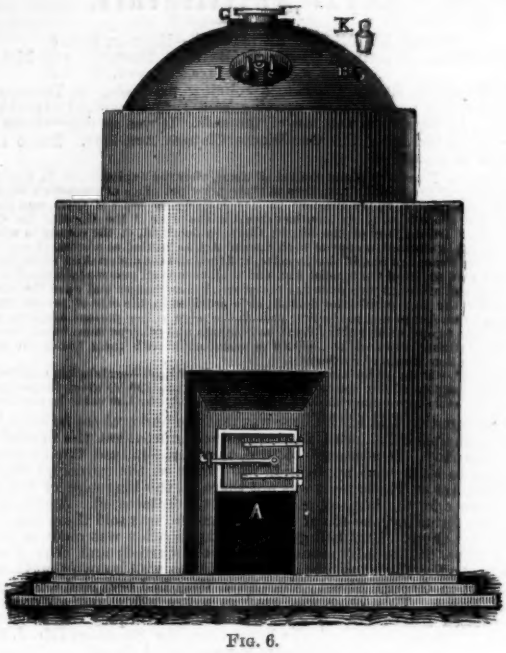


Fig. 6.

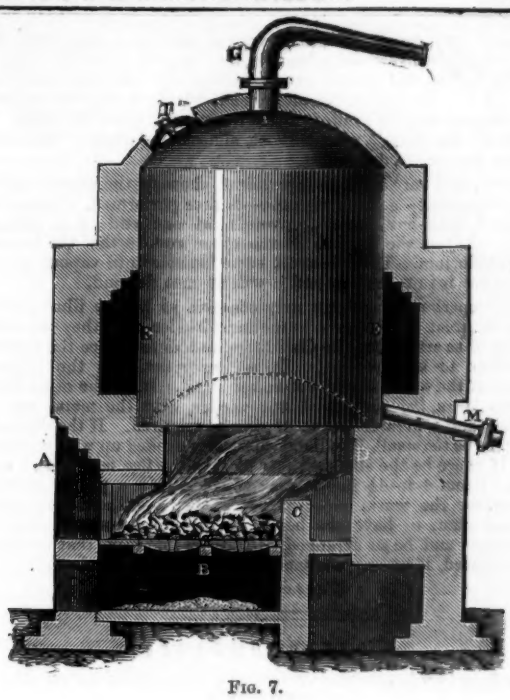


Fig. 7.

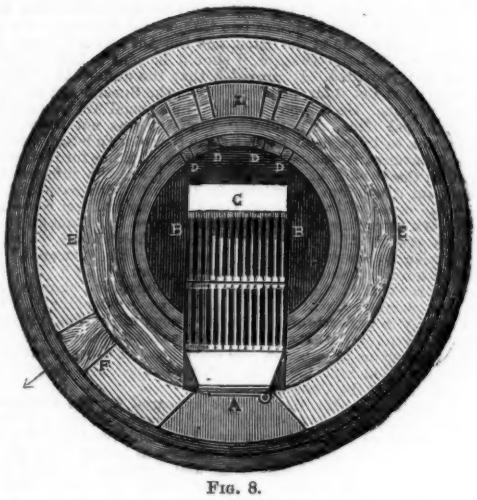


Fig. 8.

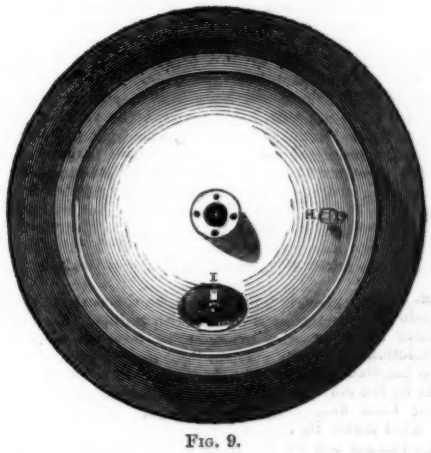


Fig. 9.

spectator is supposed to stand in front of the fire-door. The ash-pit is seen at A. The tar is pumped into the still by means of a pipe, bent at its lower end to enable it to enter the aperture H. When the still is sufficiently charged, the hole, H, can be closed by means of the conical stopper, K. At G is seen the neck of the still. It has a broad flange to enable the head seen in fig. 7 to be attached by means of screw-bolts and nuts. The fire-bars are seen in the section at B, and in the plan, fig. 8, at BB. C is the bridge, and D in the section, and DDDD in the plan, are the entrances to the flue. EE in the section, and EEE in the plan, a circular flue; its stop is shown at L, in the plan.

Fig. 9 shows a plan of the dome, which, like the still itself, may be made of $\frac{3}{4}$-inch boiler-plate.

The size of the still is a matter of considerable importance. In Scotland, where, as we have said, the tar is distilled in a current of steam, they often have a capacity of 4000 gallons, but are of totally different construction to those which are worked by direct fire. Those figured in the illustrations can be charged, worked, and the pitch run out by the cock, M, in a day. They have a working capacity of about 1200 gallons. The "worm," or condenser, may be made of cast iron, in sections, so as to form circles in the worm-tub. Some prefer the plan of the worm to be square, with rounded corners. This is a matter of taste, the chief consideration being that the worm is long enough, and the water supply adequate. From 150 to 180 feet will be sufficient. The liquid, as it runs from the worm, should never feel warm to the hand; and the nearer it is to the temperature of the water in the worm-tub the better.

As, at the commencement of the distillation, water accompanies the crude light naphtha, a separating-box should be employed. By its use the ammoniacal liquor can be run direct into tanks, which may very conveniently be sunk underground. The naphtha, which makes its exit from another tube in the separating-box, can be run into puncheons or tanks, as the operator desires. It is essential that the arrangement should be so contrived that the oils of different boiling-points may be run into separate receptacles. A separating-box will be described further on.

Supposing the still to be charged and the fire lighted, constant attention must be paid to it, lest the heating should be so rapid as to cause the contents of the still to boil over. It is, perhaps, almost needless to say that great precautions should be taken against fire. It is better that the head of the still should point away from the fire, and if the worm be separated by a brick wall from the still-house, the greater the safety. Naphtha vapour is excessively inflammable, and is so much heavier than air, that, if the cooling were neglected, and the fire too near the refrigerator, serious accidents might happen. The operator may form an idea of the heaviness and inflammability of naphtha vapour, from the three following experiments:—Place four or five beaker glasses, 6 inches deep, in a row on the table. Fasten a piece of copper about the size of a penny piece, but twice as thick, to a copper wire, and bend the latter at right angles to the copper. This is to enable it to be inserted into a beaker, or removed at pleasure. A piece of cardboard, larger than the copper, is to be placed at the bottom of the first beaker. Heat the copper to dull redness, barely visible in the dark. When it has cooled a little, but still hisses on contact with a wet finger, put it in the first beaker, allowing it to rest on the cardboard, so as to prevent it cracking the glass. Now pour two or three fluid drachms of benzole on the copper. It will boil, and be converted into vapour. If the experiment has been properly made—*i.e.*, if the copper has been heated sufficiently, and the benzole not added in too large a quantity—it will be entirely converted into vapour. Then pour the vapour, as if it were water, into the second glass, and from the second glass decant it into the third, and from the latter, finally, into the fourth. Then apply a lighted taper to the latter, which will be apparently empty. The benzole vapour will ignite with a flash, and burn for a short time.

A still more instructive experiment to the practical tar distiller is the following:—Take two boards about 4 inches wide, and 3 or 4 feet long. Get the carpenter to make them into a gutter or shoot. An end section will be in the form of a V. Support the shoot in such a manner that one end may be, say, 4 inches higher than the other. So place a beaker under the lower end that it

will catch any liquid or heavy vapour that may run down the shoot. Again convert some benzole into vapour with the piece of copper as before, and pour it into the shoot. It will run down and collect in the beaker at the other end, where it may be ignited. Or the vapour may be ignited at the lower end, while running. It will then "fire back" up the shoot, almost like gunpowder would do under similar circumstances.

Another, and very elegant experiment, showing the density of the vapour of benzole—a light naphtha—is thus performed. Suspend a pasteboard muff-box, mouth upwards, at one end of a delicate balance. Adjust the weights at the other end, so that the balance is in equilibrium. Then convert some benzole into vapour in the beaker, pour it into the box and it will at once descend.

These experiments are not only effective as lecture illustrations, but are of great significance to the tar distiller, and they show the necessity of so arranging the distilling plant as to reduce the chances of accident to a minimum. It is important that the internal diameter of the worm should not be too small. If, on the other hand, it be too large, the contact of the vapour with the metal will be imperfect, and a greater length of pipe be required. If the diameter of the pipe be too small, it is liable to become choked up with naphthalene. If there be the slightest fear of this, the fire must be at once drawn. From 4 to 4½ inches may be considered a proper internal diameter for the worm pipe. It is a very excellent, but rather expensive plan, to have the bends of the worm come outside the refrigerator, and be so arranged, with moveable caps, that the tubes can be cleared, if by any accident they should become choked.

*(To be continued.)*

## Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

### GAS *VERSUS* ELECTRIC LIGHT IN PARIS.

Sir,—In my communication of Jan. 27 (see last number of the Journal, p. 154), I omitted to state that in 1878 the electric light cost the Municipality of Paris 1 fr. 20 c. per lamp per hour. It is now supplied at the reduced price of 30 c. (3d.) There will consequently be a loss of 70 c. (7d.) on each lamp per hour. It is admitted that the Société Générale d'Electricité will have to supply their light this year at a loss instead of at a profit. But even at the reduced price to be charged, the additional expense for the electric light will be £1361 16s., while for an extra supply of gas to give an equal amount of illumination, the extra charge will be only £520 2s. Assuming that the two methods of lighting are, upon the improved plan accepted by the Municipality, equal for the purposes of illumination, gas will still be supplied at nearly one-third less than the cost of the electric light, while the stringent clause imposing additional liabilities in case of failure or extinction of the latter, if enforced, will also materially increase its cost.

This display of the electric light may serve the purpose of an experiment, or mode of advertisement to daze the public. At present, however, we have no proof—the evidence, in fact, points rather in the opposite direction—that the electric light can be worked more economically, and handled more readily than gas. It is not so agreeable to the eyesight as the old, much-maligned, yellow gas-flame, nor is its use entirely free from danger to life and limb. No electrician has yet devised by what meter its consumption can be computed, nor how the supply to consumers can be increased or diminished according to their requirements, which vary day by day, with the casualties of weather and the ever-changing emergencies of life.

It is also a somewhat singular fact that, even in America, where the world-famed Mr. Edison resides, and whence the startling announcement of fresh inventions from his fertile brain is ever coming to alarm the timid holders of gas property, no practical adoption of his discoveries on an extended scale has yet taken place. And this is the case where there seems to be every inducement for putting them in operation, seeing that gas in the United States is at so high a price, and is so largely consumed for domestic purposes. In Germany, again, the land of scientific chemistry, the same doubts exist as to the general adoption of the electric light; while in England, electricians have for the last 40 years been consuming the midnight oil in the hope of discovering some method of rendering that light available for ordinary uses. If this protracted period of infancy has been so unproductive of favourable growth, the question of maturity seems still so far distant as to justify the prediction of many practical chemists, that the electric light can never answer the expectations which the Société Générale d'Electricité fondly hope to see realized.

It behoves the public, therefore, not to be hoodwinked by theories, however plausible they may, at the first glance, seem; and they should remember that, however well adapted the electric light may be for special and exceptional cases—as, for example, where great luminous intensity is required, and the cost and difficulty of manipulation form no serious objection to its employment—at the present time it may be regarded as really unavailable for application in general illumination.

*Paris, Feb.* 6, 1879. John F. Nicholson.

### GAS COMPANIES AND THEIR CUSTOMERS.

Sir,—As there has appeared a variety of correspondence in the Journal regarding the advisability of gas companies extending their control to the point of combustion, I will be glad indeed if any of my brother managers would name any place where a "slip," containing hints as to the proper size of pipes to fit up, and description of burners best to use, has been issued to consumers, and with what effect.

I have found that in nine cases out of every ten, where complaints have been made, the deficient supply has arisen from small pipes or bad burners.

*Penicuik, Feb.* 1, 1879. Hugh M'Gillivray.

## Legal Intelligence.

TORQUAY PETTY SESSIONS.—Monday, Feb. 3.
(*Before Messrs.* Halliday, *Chairman*, Bridges, Bowring, *and* Mallock.)

CARTER *v.* TORQUAY GAS COMPANY.

Mr. Frederic Roger Carter, a solicitor practising in Torquay (who conducted his own case), in opening, said that he wished to make a few remarks in regard to the law of the case. It was an information under sections 45 and 46 of the Gas-Works Clauses Act, 1847. These clauses enacted as follows:—

Section 45.—The undertakers shall at all times, after the expiration of six months after the passing of the Special Act, keep in their principal office of business a copy of the Special Act, printed by the Printers to Her Majesty, or some of them, and shall also within the space of such six months deposit in the office of the Clerk of the Peace in England or Ireland, and of the Sheriff Clerk in Scotland, of the county in which the undertaking is situated, a copy of such Special Act so printed as aforesaid; and the said Clerk of the Peace and Sheriff shall receive, and they and the undertakers respectively shall keep the said copies of the Special Act, and shall permit all persons interested to inspect the same, and make extracts or copies therefrom, in like manner and upon the like terms, and under the like penalty for default, as is provided in the case of certain plans and sections by an Act passed in the first year of the reign of her present Majesty, intituled "An Act to compel Clerks of the Peace for counties, and other persons, to take the custody of such documents as shall be directed to be deposited with them under the Standing Orders of either House of Parliament."

Section 46.—If the undertakers fail to keep or deposit, as hereinbefore mentioned, any of the said copies of the Special Act, they shall forfeit £20 for every such offence, and also £5 for every day afterwards during which such copy shall be not so kept or deposited.

The information laid in this case was that the undertakers failed to keep in their principal office, open for inspection, as provided, the Special Act of the Company. It appeared to him, therefore—indeed, it only remained for him to show that application was made at the principal office, and that the Act of Parliament was not there, in the language of the section at all times for the inspection of any person interested. Application was made on Saturday, the 4th of January, and he was told there was no copy of the Act there. That being so, if the application was made at the principal office, the penalty named would be incurred; and that it was the principal office there could be no doubt. It was well known that their office was first in George Street; since then they had occupied a new place in Fleet Street. This place was used as a gas office, and all notices, &c., were dated from there. They were headed, "Torquay Gas Offices, Fleet Street." In addition, he had a letter from the Secretary (Mr. J. Kitson), who said, "I have just heard you have called at the office, wishing to see some Act of Parliament. If you will kindly let me know which Act it is, I will send it you." That showed two things—the Secretary was informed the call had been made at the office, and the Act was not there; but if he (Mr. Carter) would name the Act, it should be sent to him. This was not what the Act provided. It provided that the undertakers should, at all times, keep lodged at their principal office, the Special Act for the inspection of all persons. He complained that the Special Act was not deposited at the principal office, as required. The Act was not there, and it was admitted not to have been there by the Secretary's letter, which he had read; at all events, it was not there, open at all times for inspection.

Mr. *F. R. Carter* (on being sworn) said: I am the informant in this case, and am a solicitor practising in Torquay. On Saturday, Jan. 4, I went to the office of the Torquay Gas Company in Fleet Street. I there saw the clerk attending to the books—I believe his name to be Baigent; and I also saw, I think, Mr. Matthews, the Accountant. I said to the clerk, "I wish to see the Torquay Gas Act." He answered, "We have not got it here." I said, "Is this the principal office?" He replied, "I suppose it is; this is the only one." He added, "I dare say Mr. John Kitson, the Secretary, will let you see a copy at his office." I then said, "Am I clearly to understand you have no copy of the Gas Act here?" He said, "No, we have not, I am certain';" and I left the office. I believe that to be the principal office of the Company. I also produce the Secretary's letter, dated Jan. 6. It is in his writing. Mr. Kitson, I believe, is the Secretary of the Company.

Cross-examined by Mr. Baker, who appeared for the Company: I am sure it was Baigent I saw on the 4th of January. It is a fact that litigation is taking place at the present time between myself and the Company. The conversation on Jan. 4 did not take place between me and the collector (Mr. Mabin) it was between me and Baigent. I did not ask Mabin if he had the Company's Act. I do not think I spoke to Mabin at all on that day. He did not tell me it was the dinner hour, and that the Accountant was gone to dinner and would be back presently. The person I spoke to did not say "We have the Act here; it's in the safe, and you can see it when Mr. Matthews, the Accountant, returns." That occurred on the 6th of January; I am speaking now of the 4th of January. I have given the words he used then. No one said to me that the principal office was at Vaughan Parade. I was told that the office in Fleet Street was for the receipt of money—simply the Accountant's office—after I had made my fourth call, but not on the first occasions. I do not know whether on each occasion I selected the dinner hour for calling, and that each of my visits was between one and two. They were, I believe, between twelve and two. All I can say is the clerks were there attending to their books. It only came out incidentally that I could see the Act at the Secretary's office, and that was on the first occasion of calling. Baigent said, "Mr. Kitson, the Secretary, will let you see a copy at his office." The Secretary did write to me on the 6th of January, offering to send me a copy of the Act. I did not tender a shilling. They made no demand; they said they had not the Act there.

Mr. Bridges: Is there anything said in the Act about tendering a shilling?

Mr. Baker: Prior to inspection, a shilling must be tendered. The Act reads: "And shall permit all persons interested to inspect, &c., &c., and make extracts, &c., on payment of one shilling for every such inspection."

Mr. Bridges: Will you point out where that occurs?

Mr. Baker: It is in section 2 of the Act referred to, and at the end of section 45 of the Gas-Works Clauses Act. But we are summoned merely for not keeping the Act in the office, so this is not very material.

Cross-examination continued: On my calling, on Jan. 9, I saw Mr. Matthews. On that occasion I asked to see the Act. He asked me, "Which Act?" adding, "The Company have several Special Acts." He did state he should be pleased to let me see the Act, but that he must inform me this was not the chief office of the Company. It was after I had seen the Acts that he said, "This is not the principal office of the Company," and he added, "The chief office of the Company is at Vaughan Parade, where the Directors meet." Upon that I went down to see what announcement there was on Mr. Kitson's door at Vaughan Parade, and all I could see was, "Messrs. Kitson, Solicitors." Mr. Matthews did not tell me, when he showed me the Acts, that they were always there. I understood they had been sent up there for me to see. I alluded to the vexatious proceedings the Company had taken, and I did say, "If they are sharp with me, I shall be sharp with them." Beyond what I have said, I have no knowledge as to whether the Acts were in the office or not. I saw the clerks, and they told me they were not there.

Mr. Baker: Will you tell us the size of the office in Fleet Street? Is it not a small place, with a counter across it?

Mr. BRIDGES: We know the place very well.

[Some discussion here occurred as to the dates of the alleged conversations and the dates in the summons, and the Bench remarked they were then simply dealing with the first summons, which was as to Jan. 4. They had not then anything to do with the two remaining summonses, which were for Jan. 6 and 8.

Mr. BAKER (in replying) said that in this case Mr. Carter sought to enforce a penal statute against the Company, and the proceedings were not, he ventured to think, taken by him for the public good, but owed their origin to the disputes which had arisen between him and the Company. The Directors of the Company had their duties to perform, and, in the exercise of these duties, must treat Mr. Carter as they would any other person. And it was only after the proceedings taken by the Company on a former occasion that Mr. Carter commenced any proceedings for an alleged infringement of the Act. How did Mr. Carter seek to enforce the penalty he alleged to have been incurred? He went at the time he knew to be the dinner hour, and called on four days, each day at the same time, although he was told on the three first occasions that the person in charge was not there then. He said that Mr. Carter's conduct showed he was apparently desirous of finding a commission of the offence, and timed his visits accordingly.

Mr. BRIDGES: Mr. Baker, you had better put aside all question of *animus*, and give us the simple facts.

The CHAIRMAN: If Mr. Carter proves his case, he must have a conviction, regardless of anything that may have previously occurred between him and the Company.

Mr. BAKER said he thought it was a duty he owed the Directors that he should somewhat explain what he fancied was the cause of these proceedings, and he should have to call attention to the correspondence since.

Mr. BRIDGES: Why do that? We must decline to hear it. The simple question is—Has there been an infringement of the law on Jan. 4 or not?

Mr. BAKER thought he should be justified in putting in the correspondence to the extent of its reference to Mr. Carter's visit. The Company had been summoned for not keeping an Act at their office, not, as he might have done, for not producing it to Mr. Carter for inspection. He (Mr. Baker) should show that a copy was kept at the office in question on each day, and the very Act that was shown to Mr. Carter on Jan. 9 was there on Jan. 4, 6, and 8. It was quite clear the word "keep" was not intended to have the extended meaning Mr. Carter attributed to it. It did not mean, shall "keep and produce," because there was another section in the Act which made that obligatory upon the Company. Mr. Carter relied on the 45th section of the Gas-Works Clauses Act, under which the undertakers were bound to keep a copy of their Special Act, and they should permit all persons to inspect such Act. Then came the 46th section of the former Act, under which he proceeded: "If the undertakers fail to keep or deposit, as hereinbefore mentioned, any of the said copies of the Special Act, they shall forfeit £20 for every such offence." There was an express penalty, under another section, upon the person who refused to produce it, and Mr. Carter was not proceeding under that; he was proceeding for not producing the Act which was kept by the Company. The public were protected, because there was another section which inflicted a penalty upon persons who failed to produce such Act, and Mr. Carter was not proceeding under that Act. He also contended that the office in Fleet Street was not the principal office of business of the Company. It was a small office, erected for the purpose of the Accountant's attending there, and receiving moneys paid on behalf of the Company, or for receiving complaints. The principal place of business, he contended, was where the Directors met and the general management of the Company was carried on, and the place from whence they issued all their orders—not the mere Collector's office. He was not aware of any decision having been given under this particular statute, in reference to the particular place of business; but the point had arisen in reference to another matter, which placed it in an analogous position to the present case. He referred to cases where questions had arisen as to where a railway company could be said to "carry on their business," and it had been held again and again that the principal place of business was at the Secretary's office, and where the Directors met, and from whence they issued their orders. It was clear, in this case, that the offence with which the Company were charged had not been committed. Mr. Carter had not given evidence of the failure to keep the Act referred to. The Act had been in the office to which he went, was there on the 4th of January, and always had been. The Company would consequently be entitled to have the case dismissed.

The following evidence was then given:—

Mr. *William Mabin*, examined by Mr. BAKER, said: I am the Collector to the Company, and was at the office when Mr. Carter called on the 4th of January. He spoke to me, not to Baigent. Mr. Carter asked if we had the Torquay Gas Act there. I told him we hadn't it at hand; Mr. Matthews, the Accountant, had it in the box. I told Mr. Carter to apply to the Secretary, Mr. John Kitson. Mr. Carter called about one o'clock.

Cross-examined by Mr. CARTER: Baigent was in the office with me, standing up at the books. I was in front of the counter. I do not think I was sitting down; I might have been sitting down. I do not think Baigent said, "We have not got it here." Will swear I did not say so. Do not remember your asking Baigent to let you see the Act. I gave you an answer, in reply to your question: "I believe the Act of Parliament is here, but it is in the iron safe. If you apply to the Secretary, Mr. John Kitson, he will give you a satisfactory answer." I knew it was in the office, I had seen it a day or two previously. Matthews kept the key of the safe. The safe was opened every day. I had no control over the safe. I knew there was an Act of Parliament there, but could not tell which. We keep all the rental-books in that office.

Re-examined by Mr. BAKER: The book now produced, containing the Torquay Gas Acts, is the book we had in the office.

Mr. *F. Baigent:* I have been in the employ of the Company about two months, and was at the Collector's office in Fleet Street on the 4th of January, when Mr. Carter called. Mr. Carter spoke to Mabin. I was attending to the books when Mr. Carter called, so did not hear exactly what he said to Mabin, nor what Mabin replied. I heard Mabin say that the Gas Act was in the safe. I am sure the conversation which took place on the 4th of January was with Mabin and not with me. I saw Mr. Carter when he called on the 6th of January.

Cross-examined by Mr. CARTER: We use the office for collecting the gas-rents. We have frequently to refer people to the Secretary's office. People do make complaints at the office, but frequently through the Secretary, to whom all the communications are sent, unless the complaints are made personally to us. Will swear I did not speak to you on Jan. 4. You did not ask me to show you the Gas Act. I will not swear I did not speak at all. We had the Act of Parliament in the safe, under the desk, where I was standing. The safe was locked, I suppose; but I did not try it. I heard Mabin say you could see it at Mr. Kitson's, the Secretary's offices. Mr. Matthews has the control of the safe. Have seen Mr. Matthews looking at the Act. Had you called at proper hours you could have seen it. You called between one and two o'clock. It is a proper time for me to work between the hours named. I am there when Matthews goes to dinner. I told Matthews, on his return, you had been there, and had asked for the Gas Act. The office is open from 9 to 5.30.

Mr. *J. J. Matthews:* I am the Accountant of the Company, and have been so since August, 1876. There is a copy of the Gas Act, 1860, in the book printed by the Queen's Printers. On Jan. 4, the book was in the safe in the office in Fleet Street. It is kept there for the public to see, and for reference. It was there on Jan. 4. I did not see Mr. Carter on that day. I was at the works paying the men; but I was informed he had been there, and I saw him on Jan. 9.

Mr. BAKER: What conversation took place between you on the 9th?

Mr. CARTER: I object.

Mr. BAKER: Any conversation which took place between the complainant and an officer of the Company is evidence, as having reference to the Act being in that particular office.

*Witness:* I said, "What Act do you require?" I said, "We have three special Acts." I then took out the book containing the Acts, and said, "I am pleased to let you see them, but must inform you the chief office is at 1, Vaughan Parade, where the Directors meet." Mr. Carter opened the book, and made some remark about the gas question. He said, "If they are sharp with me, I will be sharp with them." On my oath, this book, containing the Acts of Parliament, printed by the Queen's Printers, was in the office on Jan. 4.

Cross-examined by Mr. CARTER: The book containing the Acts was in the office for the use of the office, and to be used in accordance with the spirit of the Act. I saw the Secretary on the evening of Jan. 6. I had had no conversation with the Secretary about that being the principal office before you saw me on Jan. 9. I receive all my orders from the Secretary's office, Vaughan Parade. The Directors of the Company meet there at different times. I am not aware that there is anything to inform the public that Messrs. Kitson's offices are connected with the Gas Company.

Mr. BOWRING: Did you hear that Mr. Carter called on Jan. 4?

*Witness:* Yes; and I asked if they had said the Act could be seen at Vaughan Parade, and they answered "Yes." I was absent from 10 to 1.30 on that day. The safe happened not to be locked, but the others were not aware of that fact. The book has been shown many times. I have referred to it with the Magistrates Clerk. On that day there was really nothing to prevent them opening the safe. The Justices Clerk has seen the book there.

Mr. BRIDGES: But did he see it on Jan. 4?

Mr. BAKER: It shows the book was kept there, both before and after, and this avoids the suggestion that it might have been placed there since.

Mr. *John Kitson:* I am the Secretary of the Torquay Gas Company. The Directors meet in a room attached to our office. All orders for conducting the business of the Company emanate from Vaughan Parade. The books are kept there, and payments made by the Company take place there, and applications are made to me there for payments due from the Company. The office in Fleet Street is for the receipt of the gas-rents, and for receiving complaints, and orders for coke. The office in Fleet Street is small. To my knowledge, the Acts of Parliament are kept in the office in Fleet Street, and, so far as I know, kept there continuously. The officers have orders to refer for instructions to 1, Vaughan Place.

Mr. BOWRING: The public are not made aware of all this?

*Witness:* I am not aware any publicity is requisite. I have never heard of any one experiencing any difficulty in finding the Secretary's office.

Cross-examined by Mr. CARTER: The object of the request on the bills, that all complaints may be made at the office in Fleet Street, is that they should have immediate attention. The books of the Company are kept in my office. The books kept in Fleet Street are merely the rental and index books.

By Mr. BRIDGES: The Company do not pay Messrs. Kitson any rent for the use of the room at Vaughan Parade.

Cross-examination continued: The building in Fleet Street belongs to the Company, and was built for the particular purpose to which it is devoted. I supplied the Acts to the office in Fleet Street not long after the place was built. The object of my doing so certainly was not because I believed it to be the principal office of the Company.

Re-examined by Mr. BAKER: The object was to afford facilities to the public and the officials.

Mr. BAKER: I do not know what my friend means to do.

Mr. CARTER, in replying, said: I assumed that this was the principal office, and that the Act was not then open for inspection. I want to draw attention to the words of the section: "The undertakers shall at all times, after the expiration of six months, keep in their principal office a copy of the Special Act printed, &c., and permit all persons interested to inspect the same, and make extracts, &c., therefrom, at all times," &c. Assuming the Act of Parliament was there locked up, it would be an evasion of the law; it would not be open at all times to inspection.

Mr. BRIDGES: The difficulty is whether the summons says anything with regard to inspection.

After the Bench had consulted a short time,

The CHAIRMAN said: We do not think the offence with which the Company are charged has been proved so as to warrant us in convicting.

Mr. BAKER applied for costs, but

The CHAIRMAN stated the Bench were of opinion that the parties should pay their own costs.

Mr. CARTER applied for a case for a Superior Court, which was granted.

## Miscellaneous News.

### ON THE QUANTITY AND QUALITY OF THE WATER SUPPLIED TO LONDON DURING 1878,

BEING THE ANNUAL REPORT SUBMITTED TO THE SOCIETY OF MEDICAL OFFICERS OF HEALTH.

By CHARLES MEYMOTT TIDY, M.B., F.C.S., &c.

To the President, Council and Members of the Society of Medical Officers of Health,

Gentlemen,—An average of 546,302 houses have been supplied, during the past year, with a daily average of 129,666,196 gallons of water, by the eight London Companies entrusted by Parliament with the supply of water to the Metropolis. This is at the rate of rather more than 237 gallons per house, or (taking the estimated population of London in the middle of the year as 3,577,304) of 36 gallons per head of the population. The details of these numbers are stated in Table I. The number of houses supplied by these eight Companies showed in December, 1878, an excess of 15,837 over those supplied in December, 1877. The gigantic task of the water supply to London is, therefore, calling year by year for increased energy. Nor have we in this respect found the Companies fail in the duties they have undertaken.

Of this (in round numbers) 130 million gallons constituting the daily supply of London, about one-half, or 65 million gallons, is taken from the River Thames; 57 million gallons from the Lea and New River, and the remaining 8 million gallons (or less than the 1-16th of the whole) from deep chalk wells.

The minimum supply during the year was in February—117,232,923 gallons; and the maximum in July—148,360,908 gallons.

The waste of water in London, these figures prove, must be enormous. This is due to the intermittent system still largely in use, but which, however, is fast giving way to constant supply. Of the 552,955 houses supplied in December, 1878, 122,242 were supplied on the constant service; and, I am glad to say, this number is rapidly increasing. To effect so radical a change must, however, be a work of time.

Having thus dealt with the quantity of water supplied during the year, I have now to deal with its quality.

As usual, the samples examined have been collected monthly by myself from the various stand-posts supplied by the several Companies, without the Officers of the Companies having any knowledge of the time when the water would be drawn. In this way perfectly fair average samples were provided for analysis.

In Table II. I submit to you the composition of monthly samples of the water of the River Thames in its unfiltered condition. They were collected at Hampton, opposite the works of the West Middlesex Water Company. In Table III. I have, as usual, given the average composition of the water of the London Companies during 1878, the detailed analysis of the several samples having been month by month duly submitted to you.

*Grand Junction.*—The total solid matter obtained by evaporation to dryness ranged from 17·00 grains per gallon in August, to 23·70 grains in January; the nitrogen, as nitrates, from 0·090 grain in January, to 0·195 grain in November. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in October, 0·042 grain, and the maximum in January, 0·114 grain.

The samples collected in June, July, August, and November contained a slight trace of suspended matter. In the other months the water was clear.

*West Middlesex.*—The total solid matter ranged from 17·10 grains per gallon in April, to 23·30 grains in December; the nitrogen, as nitrates, from 0·075 grains in October, to 0·159 grain in February. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon, was in August, 0·050 grain, and the maximum in January, 0·142 grain.

The samples collected in July and November contained a slight trace of matter in suspension. In the other months the water was clear.

*Southwark and Vauxhall.*—The total solid matter ranged from 17·30 grains per gallon in August, to 22·20 grains in December; the nitrogen, as nitrates, from 0·90 grain in July, to 0·150 grain in February. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in October, 0·037 grain, and the maximum in December, 0·115 grain.

The samples collected in January and September contained a trace of suspended matter. In the other months the water was clear.

*Chelsea.*—The total solid matter ranged from 16·70 grains in August, to 22·50 grains in December; the nitrogen, as nitrates, from 0·75 grain in July, to 0·165 grain in February and November. The minimum amount of oxygen needed to oxidize the organic and other matter per gallon was in November, 0·007 grain, and the maximum in June, 0·090 grain.

The samples collected in no case contained a trace of suspended matter.

*Lambeth.*—The total solid matter ranged from 18·70 grains per gallon in July, to 23·60 grains in February; the nitrogen, as nitrates, from 0·105 grains in July and December, to 0·165 grain in February. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in October, 0·023 grain, and the maximum in December, 0·103 grain.

The samples collected in January and September contained a trace of suspended matter. In the other months the water was clear.

*Kent.*—The total solid matter ranged from 25·40 grains per gallon in October, to 32·00 grains in May; the nitrogen, as nitrates, from 0·195 grain in March, to 0·600 grain in October. The amount of oxygen needed to oxidize the organic and other matters per gallon ranged from 0·000 grain in March, to 0·014 grain in April.

The samples collected were uniformly bright and clear.

*New River.*—The total solid matter ranged from 17·40 grains per gallon in April and August, to 21·90 grains in January; the nitrogen, as nitrates, from 0·184 grain in March, to 0·195 grain in February. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in August, October, and November, 0·017 grain, and the maximum in September and December, 0·057 grain.

The samples collected from the mains were, without exception, bright and clear.

*East London.*—The total solid matter ranged from 17·90 grains per gallon in September, to 24·90 grains in February; the nitrogen, as nitrates, from 0·060 grain in January, to 0·165 grain in April. The minimum amount of oxygen needed to oxidize the organic and other matters per gallon was in March, 0·032 grain, and the maximum in February, 0·066 grain.

The samples, as collected from the Company's mains, were, without exception, perfectly bright, and free from suspended matter.

The inorganic constituents of the several waters are stated in Table III I have many times directed your attention, not only to the harmless nature of these constituents, but also to the fact that, from a medical point of view, they are wholesome—nay, indeed, essential to health. I regret that Dr. Frankland, therefore, still uses the phrase, "Total solid impurity," to express these constituents; for in no true sense can they be regarded as impurities, but the reverse.

The organic impurity of the water is that which necessarily attracts attention. In Table IV., I have stated the oxygen required to oxidize the organic and other oxidizable constituents in the monthly samples examined during the year. Regarded from this point of view, it would appear that the following is the order of purity of the water supplied by the five Companies that derive their water from the Thames, beginning with the purest—viz., Chelsea, Lambeth, Southwark and Vauxhall, Grand Junction, and, lastly, the West Middlesex. At the same time, I should add that the water supplied by all five Companies was in every respect wholesome, and well fitted for a town supply. The New River water maintained throughout the year its accustomed remarkable purity, whilst the water supplied by the East London Company was also uniformly of excellent quality.

Of the water supplied to London, therefore, during 1878, I can only re-echo the views expressed by a Select Committee of the House of Commons in 1867, that it is satisfactory, both as regards quantity and quality.

I remain, Gentlemen, your faithful servant,

C. Meymott Tidy.

*3, Mandeville Place, Manchester Square, W., Jan. 10, 1879.*

Table I.

*Average Daily Supply to the Metropolis during* 1878.

(Estimated Population, 3,577,304.)

| 1878. | Gallons per Diem. | Houses Supplied. | Gallons per Head Daily, including Waste. |
|---|---|---|---|
| January . . . | 117,529,216 | 540,961 | 32·8 |
| February . . . | 117,232,923 | 541,475 | 32·8 |
| March . . . . | 119,981,575 | 542,570 | 33·5 |
| April . . . . | 118,335,453 | 542,390 | 33·0 |
| May . . . . | 125,453,898 | 543,206 | 35·0 |
| June . . . . | 130,142,203 | 544,581 | 36·1 |
| July . . . . | 138,360,908 | 547,528 | 41·4 |
| August . . . | 144,956,518 | 548,349 | 40·5 |
| September . . | 137,389,525 | 549,627 | 38·4 |
| October . . . | 135,729,442 | 550,374 | 37·0 |
| November . . | 130,795,871 | 551,509 | 36·2 |
| December . . | 130,086,702 | 552,955 | 36·3 |
| Average . . | 129,666,196 | 546,302 | 36·0 |

*Note.*—It is believed these quantities are given upon the gross capacities of the pumps, and that they are consequently subject to a deduction of about 10 per cent. to arrive at the net quantities.

Table II.

*Composition of the (Unfiltered) Water of the River Thames, taken at Hampton, opposite the Works of the West Middlesex Water Company, Month by Month, during the Year,* 1878.

(The results are stated in Grains per Imperial Gallon of 70,000 Grains.)

| 1878. | Ammonia. | | Nitrogen, as Nitrates, &c. | Oxygen required to Oxidize the Organic Matter, &c. | Total Solids. | Lime. | Magnesia. | Chlorine. | Sulphuric Anhydride. | Hardness. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Saline. | Organic. | | | | | | | | Before Boiling. | After Boiling. | |
| | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Degrees. | Degrees. | |
| January 10 . . . . . | 0·007 | 0·012 | 0·120 | 0·126 | 23·00 | 9·07 | 0·612 | 0·870 | 1·96 | 15·4 | 3·7 | Very turbid. |
| February 12 . . . . . | 0·000 | 0·010 | 0·168 | 0·059 | 21·80 | 9·53 | 0·468 | 0·870 | 1·40 | 14·3 | 3·7 | Very slightly turbid. |
| March 11 . . . . . | 0·000 | 0·009 | 0·120 | 0·060 | 21·80 | 8·51 | 0·540 | 0·870 | 1·20 | 14·3 | 3·7 | Clear. |
| April 10 . . . . . | 0·000 | 0·009 | 0·129 | 0·064 | 19·30 | 8·40 | 0·396 | 0·870 | 1·33 | 13·7 | 3·3 | Clear. |
| May 11 . . . . . | 0·000 | 0·008 | 0·150 | 0·066 | 19·60 | 8·28 | 0·360 | 0·940 | 1·60 | 13·7 | 3·3 | Clear. |
| June 10 . . . . . | 0·000 | 0·008 | 0·129 | 0·094 | 20·50 | 8·84 | 0·723 | 1·010 | 1·40 | 14·8 | 3·3 | Clear. |
| July 10 . . . . . | 0·001 | 0·009 | 0·125 | 0·078 | 17·60 | 5·42 | 0·684 | 1·010 | 1·07 | 14·3 | 3·0 | Clear. |
| August 3 . . . . . | 0·001 | 0·010 | 0·120 | 0·078 | 18·30 | 8·01 | 0·540 | 1·010 | 1·03 | 13·2 | 2·8 | Clear. |
| September 9 . . . . . | 0·000 | 0·015 | 0·105 | 0·132 | 20·60 | 8·73 | 0·576 | 1·080 | 1·43 | 14·3 | 3·0 | Very slightly turbid. |
| October 10 . . . . . | 0·004 | 0·015 | 0·165 | 0·088 | 19·90 | 7·46 | 0·684 | 0·864 | 1·26 | 13·7 | 2·0 | Very turbid. |
| November 11 . . . . . | 0·002 | 0·010 | 0·120 | 0·110 | 23·00 | 8·96 | 0·720 | 0·790 | 1·40 | 13·7 | 4·2 | Very turbid. |
| December 12 . . . . . | 0·000 | 0·010 | 0·090 | 0·071 | 24·30 | 7·50 | 0·720 | 0·720 | 2·00 | 16·5 | 5·1 | Very turbid. |

Table III.

*Average Composition and Quality of the Metropolitan Water during the Year* 1878.

| The Quantities of the Several Constituents are calculated in Grains per Imperial Gallon (70,000 Grains). | Ammonia. | | Nitrogen, as Nitrates, &c. | Oxygen required to Oxidize Organic Matter, &c. | Total Solids. | Lime. | Magnesia. | Chlorine. | Sulphuric Anhydride. | Hardness on Clark's Scale. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Saline. | Organic. | | | | | | | | Before Boiling. | After Boiling. |
| Thames Water Companies— | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Grains. | Degrees. | Degrees. |
| Grand Junction . . . . . | 0·000 | 0·0100 | 0·134 | 0·0711 | 20·23 | 7·886 | 0·498 | 0·885 | 1·367 | 13·7 | 3·4 |
| West Middlesex . . . . . | 0·000 | 0·0093 | 0·114 | 0·0736 | 19·76 | 7·884 | 0·546 | 0·890 | 1·451 | 13·5 | 3·4 |
| Southwark and Vauxhall . . | 0·000 | 0·0095 | 0·120 | 0·0699 | 19·66 | 7·642 | 0·533 | 0·902 | 1·445 | 13·7 | 3·5 |
| Chelsea . . . . . | 0·000 | 0·0088 | 0·129 | 0·0510 | 19·32 | 7·625 | 0·507 | 0·880 | 1·371 | 13·7 | 3·3 |
| Lambeth . . . . . | 0·000 | 0·0100 | 0·136 | 0·0661 | 20·90 | 8·063 | 0·492 | 0·912 | 1·527 | 13·9 | 3·5 |
| Other Companies— | | | | | | | | | | | |
| Kent . . . . . | 0·000 | 0·0020 | 0·404 | 0·0043 | 28·71 | 10·936 | 0·843 | 1·480 | 3·434 | 19·3 | 5·8 |
| New River . . . . . | 0·000 | 0·0066 | 0·151 | 0·0368 | 19·57 | 7·968 | 0·485 | 0·890 | 0·990 | 13·7 | 3·1 |
| East London . . . . . | 0·000 | 0·0071 | 0·110 | 0·0472 | 20·50 | 7·800 | 0·665 | 1·082 | 1·557 | 13·6 | 3·7 |

*Note.*—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

TABLE IV.

*Table showing the Quantity of Oxygen required to Oxidize the Organic and other Oxidizable Constituents in the London Waters, Month by Month, during the Year* 1878.

(The results are expressed in Grains per Imperial Gallon of 70,000 Grains.)

| 1878. | Jan. | Feb. | March. | April. | May. | June. | July. | August. | Sept. | Oct. | Nov. | Dec. | Average. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Thames and other Companies— | | | | | | | | | | | | | |
| Grand Junction | 0·114 | 0·052 | 0·051 | 0·089 | 0·066 | 0·101 | 0·068 | 0·046 | 0·089 | 0·042 | 0·061 | 0·075 | 0·0711 |
| West Middlesex | 0·142 | 0·063 | 0·062 | 0·053 | 0·084 | 0·073 | 0·067 | 0·050 | 0·089 | 0·055 | 0·057 | 0·089 | 0·0736 |
| Southwark and Vauxhall | 0·060 | 0·049 | 0·061 | 0·046 | 0·077 | 0·098 | 0·067 | 0·053 | 0·103 | 0·037 | 0·073 | 0·115 | 0·0699 |
| Chelsea | 0·053 | 0·052 | 0·048 | 0·046 | 0·056 | 0·090 | 0·057 | 0·035 | 0·042 | 0·052 | 0·007 | 0·073 | 0·0510 |
| Lambeth | 0·078 | 0·045 | 0·062 | 0·042 | 0·063 | 0·093 | 0·068 | 0·050 | 0·096 | 0·023 | 0·069 | 0·103 | 0·0660 |
| Average | 0·0884 | 0·0522 | 0·0568 | 0·0552 | 0·0692 | 0·091 | 0·0654 | 0·0468 | 0·0838 | 0·0418 | 0·0534 | 0·0910 | 0·0663 |
| Other Companies— | | | | | | | | | | | | | |
| Kent | 0·009 | 0·003 | 0·000 | 0·014 | 0·001 | 0·003 | 0·010 | 0·008 | 0·001 | 0·003 | 0·003 | 0·002 | 0·0043 |
| New River | 0·058 | 0·038 | 0·024 | 0·042 | 0·024 | 0·045 | 0·046 | 0·017 | 0·057 | 0·017 | 0·017 | 0·057 | 0·0368 |
| East London | 0·047 | 0·065 | 0·032 | 0·042 | 0·049 | 0·056 | 0·046 | 0·039 | 0·053 | 0·038 | 0·034 | 0·065 | 0·0472 |

## METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in January, 1879:—

| NAMES OF WATER COMPANIES. | Total Solid Matter per Gallon. | Oxygen required by Organic Matter, &c. | Nitrogen. — As Nitrates, &c. | Ammonia. Saline. | Ammonia. Organic. | Hardness (Clark's Scale). Before Boiling. | Hardness (Clark's Scale). After Boiling. |
|---|---|---|---|---|---|---|---|
| *Thames Water Companies.* | Grs. | Grs. | Grs. | Grs. | Grs. | Degs. | Degs. |
| Grand Junction | 21·40 | 0·130 | 0·165 | 0·000 | 0·012 | 13·2 | 5·1 |
| West Middlesex | 20·00 | 0·120 | 0·165 | 0·000 | 0·015 | 14·3 | 4·6 |
| Southwark and Vauxhall | 18·20 | 0·135 | 0·105 | 0·000 | 0·011 | 11·5 | 5·1 |
| Chelsea | 20·10 | 0·033 | 0·210 | 0·000 | 0·007 | 13·2 | 3·3 |
| Lambeth | 21·30 | 0·037 | 0·135 | 0·000 | 0·009 | 13·7 | 3·7 |
| *Other Companies.* | | | | | | | |
| Kent | 29·30 | 0·002 | 0·435 | 0·000 | 0·003 | 19·4 | 6·5 |
| New River | 21·30 | 0·030 | 0·165 | 0·000 | 0·007 | 14·3 | 3·7 |
| East London | 23·00 | 0·049 | 0·135 | 0·000 | 0·011 | 14·3 | 3·7 |

*Note.*—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases but the following, when it was slightly turbid, namely—Grand Junction, Southwark and Vauxhall, Chelsea, and Lambeth.

C. MEYMOTT TIDY, M.B., &c.

## THE CHARTERED GAS COMPANY'S EXPERIMENTS WITH THE ELECTRIC LIGHT.

The following Report of the Committee appointed by the Court of Directors of The Gaslight and Coke Company on July 5, 1878, to investigate the question of producing light by means of electricity, together with its cost and illuminating power as compared with an equal amount of light when produced by gas, has been issued with the Report of the Directors and the Accounts of the Company for the past half year, in anticipation of the meeting of Shareholders on Friday next:—

The Committee having considered the best-known form of electric machine for producing the light, selected the dynamo-electric machine of Messrs. Siemens, together with a regulating lamp constructed on the Serrin principle, but improved by Messrs. Siemens. The electric machine is one of Siemens smallest size, and cost, with the necessary conducting wires, lamp, glass shades, fixing, and everything necessary for putting the same into action, £150.

The motor for working the electric machine is one of the steam-engines used for pumping gas from the Company's Beckton main into the gas-holders at Westminster. This engine is of about 10-horse power, and is fixed in the exhauster-room, and during the whole of the trials with the electric light the exhausters were thrown out of action, so that the engine and boiler (an upright one) were exclusively used for driving the machine. Every care was taken to ascertain the amount of power required to work it, as well as the amount of fuel (coke) used for the boiler, and the engine was constantly being tested by indicator diagrams. At first starting, great difficulties occurred before an uniform speed of the engine, and consequently of the machine, could be obtained; but after a number of alterations had been made to the governor, &c., very fair results were obtained. There was, however, at times, some irregularity in the speed, which was, without doubt, partly caused by the machine itself. Regularity in working these machines appears to be indispensable. The Committee, therefore, with your approval, have ordered one of Otto and Langen's gas-engines, with which they hope to obtain better results in every way, all of which will be duly communicated to you in a subsequent report.

Pending the fixing of the Otto engine, the Committee consider it desirable that the results of their experiments with the steam-engine as a motor should be reported to you; and they therefore beg leave to lay before you the same, as far as they have gone.

The experiments on the illuminating power, and the testing of the lights themselves, have been made at the Chief Offices of the Company, in the Horseferry Road, Westminster, in a room 98 feet long by 45 feet wide, and 28 feet high. This room is lighted by four sun burners, each containing 63 jets of gas, and requiring about 190 feet of gas per hour, or 760 feet for the four burners. The Committee are of opinion that these burners are too near the ceiling, and are consequently not well fixed to give the greatest amount of light to the room of which they are capable. It is, however, well lighted by them, although, by a better arrangement, a greater amount of light could no doubt be obtained. The amount of light produced by this consumption of gas would be about 2430 candles; and, calculating the amount of gas required to produce the same amount of light as that obtained from electricity, the consumption of gas would be reduced to 540 feet per hour, or 540,000 feet for the 1000 hours, during which time each system has been calculated to continue in operation.

The conducting wire from the machine to the lamp is 150 yards long, with a like length for the return wire. Both are formed of seven wires, coiled into a cable, and the whole is well insulated by gutta-percha and india-rubber. The cable is ¾-inch in diameter.

The lamp, as before stated, is that known as the Siemens Improved Serrin, and consists of a magnetic arrangement, by which the carbons (which are placed vertically) are kept at the proper distance apart by the electric current itself, so as to ensure the electric arc being always at the proper distance between the proper points. This arrangement is necessary, as, independent of the consumption of the carbons, the current of electricity varies as the speed of the engine varies—an objection which, with all the care and attention bestowed on it, cannot at present be entirely removed.

The current produced by the machine is a continuous one—that is, always in one direction, and not, as in the Jablochkoff and some other systems, where the current is alternating.

Having, after some trouble and constant attention, got the electric light into fair working order, it became necessary to ascertain its value in illuminating power as compared with gas, and this was effected in the following manner:—The standard of comparison was by means of an arrangement devised by Mr. T. W. Keates, the Consulting Chemist to the Metropolitan Board of Works, in which a sperm oil lamp was adjusted to a 2-inch flame, so as to give a light equal to 16 sperm candles, six to the pound. This was fixed at one end of a 100-inch bar photometer, fitted with screens so as to cut off the reflected rays, as prescribed by the Metropolitan Gas Referees. At the other end of the photometer a Sugg's concentric ring "London" Argand burner was fixed, giving a light equal to from 112 to 130 candles. These variations have been calculated for in the course of the experiments. At a distance of 60 feet at right angles to this standard gas-burner, and on a level with it, the electric lamp was fixed, and between it and the gas-burner a paper moveable disc was placed, so that the intensity of each light was shown on the disc in the usual manner. Observers were constantly taking notes of the illuminating power of the electric light as compared with that of gas, and another set were recording the illuminating power of the gas as compared with that of the oil lamp. The number of revolutions of the machine, as well as the horse power required to work it, were also simultaneously noted.

The first series of experiments was made with the electric light fully exposed, which made it rather difficult for the observer to read the disc properly, the sight being impaired by the brilliant light, and it was found necessary to change the observer after each observation. The average, however, of a number of experiments gave an illuminating power for the electric light of 1727 candles, the variations being from 1400 to 1900 candles. The power to produce this amount of light was about that of four horses, and the speed of the machine was 1000 revolutions per minute.

The carbons burned steadily, although on two or three occasions there was some flickering noise. The light was very brilliant and intense, so much so as to be painful to the eyes. There was also a strong pungent smell, indicating the presence of ozone. We are now investigating this feature, and have clearly proved that carbonic acid is produced as well as some form of nitrogen. The existence of the latter product has been confirmed by an eminent chemist, who asserts it to be nitric acid; but on this point subsequent experiments will be conducted. There was also a considerable amount of heat produced, and this, we are informed, is always perceptible where the light is produced in close apartments.

Mr. Sugg informs us that the light obtained during these experiments was the best he has ever seen, and he witnessed the competitive trials made in Paris by the several electrical inventors, when exhibiting before the jurors. To say, however, that the room was well lighted would not be correct, as the ends of it were in comparative shade, and when the four sun burners were turned up, and the electric light was extinguished, an altogether better illumination was obtained, the appearance of the room was much improved, and the relief to the eyes was most grateful.

We then tried the illuminating power of the electric light when shaded by an albatrine globe 6 inches in diameter, and found a very considerable loss of light. The greatest amount obtained was 851 candles, and the lowest 414, the mean being 632 candles, showing a loss of over 60 per cent. The room, however, appeared to be more agreeably lighted, so far as the eye was concerned, notwithstanding the loss of light.

In making the trials of electric *versus* gas light, the electric light has been placed in the centre of the room, and 15 feet above the floor. The gas burners, however, being over 20 feet above it, the advantage of position was given to the electric light.

We have found that a great deal of the steadiness of the light depends on the carbons being made properly, and of uniform texture. On some occasions the upper carbon flies off in white-hot portions, and falls to the ground, and if no one were present, might set the place on fire. These defects entail an immense amount of care and watchfulness. However, with good carbons and a metal cage, such as we were obliged to adopt to catch the burning pieces, this source of danger may be much lessened.

Our observations have not yet been directed to any other forms of electric lamps, such as the Rapieff, Werdermann, Jablochkoff, &c.; but, if we can obtain them, we think trials should be made.

We are quite satisfied that the electric light can never be applied indoors without the production of an offensive smell, which undoubtedly causes headache, and in its naked state it can never be used in rooms, of even large size, without damage to the sight.

The Company's Inspectors, who use the room in which the experiments have been conducted, and who have a great deal of writing to do, have begged that no further experiments be made while they are at work in it. When the light is modified by thick shades it is more bearable; but it has been generally remarked that, there being so much of the violet and actinic ray proceeding from it, a most cadaverous appearance is given to the countenance. Of course, thick shades to obscure the light imply increased cost.

We obtained a large number of pieces of various coloured silks of all shades, but we failed to discover that the electric light conferred any advantages over gas light in distinguishing the shades of colour, and it has been stated by an eminent dyer of army cloth that scarlet is largely deteriorated by it.

We also made some experiments by photography and printing from negatives, and found, as we expected, that we could produce the same

results from both systems of lighting; the superiority, however, in point of time, being greatly in favour of the electric light.

No doubt the present novelty of the apparatus and the management of it require a greater amount of skill on the part of the attendants, than will be found necessary when all the details are better understood; but we venture to say that the labour and skill required to keep this delicate and highly scientific apparatus in proper order is such as will preclude its use for domestic purposes, independently of its cost as compared with gas light. Unquestionably there may be places (where expense is of no consideration) where it may be used with advantage; but, even for such places, a great deal has yet to be done, before it can be adopted in a practical manner.

Although the electric light has in a few places, been exhibited in the open air, we are not aware of its having been tried in any theatre, or similar place of public resort, under cover. It is, however, in use in the machine-room of *The Times* newspaper office, and is now being experimented with at Billingsgate Market, where it does not appear at present to realize all that was predicted of it—although here it should have succeeded, if anywhere—and we have not at present any detail of its cost as compared with that of gas. The same remarks apply to the experiments on the Holborn Viaduct and the Thames Embankment.

Having now stated our general views on the question submitted to us, we beg leave to lay before you statements of the comparative cost of working both systems of lighting, and which are based on the actual cost, as nearly as we can arrive at them. We also give an estimate of cost in using a gas-engine, in lieu of steam, as a motive power for working the electric machine. In all cases we have, as before stated, estimated the lights to be in action for 1000 hours.

*Table No.* 1

Shows Cost of Producing the Electric Light when Steam is Employed.

This table gives the amount of capital required for obtaining a light by means of electricity, burning for 1000 hours, together with the cost of working the same, and allowing only a fair interest for wear and tear and interest of outlay; and it will be seen that the cost per hour amounts to 4s. 6d. with a naked light, and to 9s. with a shaded light.

*Table No.* 2

(Cost of Lighting Room by Gas)

Is an estimate of the cost of the four gas sun-burners, and which, brought to the same illuminating power as that obtained by the electric light, amounts to 2s. 3d. per hour, as against 4s. 6d. by the naked light, and 9s. with the shaded light, or four times as much.

*Table No.* 3

(Cost of the Electric Light when a Gas-Engine is the Motor)

Shows the cost if a gas-engine is employed, and amounts to 3s. 3d. per hour, as against 4s. 6d. when the light is obtained by steam power.

In these estimates, although the actual loss of light when an opal glass is used is over 60 per cent., we have only estimated a loss of 50 per cent.

An analysis of these figures gives the following results:—

| | Per Hour. |
|---|---|
| Cost of electric light worked by steam-engine | 4s. 6d. |
| Cost of electric light worked by gas-engine | 3 3 |
| Cost of electric light when shaded | 9 0 |
| Cost of lighting Inspectors office by gas | 2 3 |

We consider that the electric light, in these experiments, has been obtained under the most favourable circumstances, and that the gas has not done so well as it might do under a better arrangement. We, however, think that quite enough has been shown to prove the superiority of gas in every way. We think the electric light, when applied to street lighting, will prove still more costly.

We are of opinion that gas as a motive power is less costly than steam, and is in every way superior, especially as regards safety. The power can be obtained at once, and there is no loss in putting it in action or in stopping it; whereas with a steam-engine an hour is required to get the steam up to work the machine, and a great loss occurs when the steam is let down; in both cases, fuel and labour are unnecessarily wasted, and a larger amount of space is required than when a gas-engine is employed.

Lastly, we deem it of the utmost importance to state that, for safe working, it is indispensable that the whole of the apparatus for the electric light should be in duplicate, by which the cost of the light will be enormously increased.

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TABLE No. 1.

Estimate of the cost of working a dynamo-electric machine by steam power, capable of producing a light of 1727 candles, as observed by the photometer, the power required to work the machine being equal to that of four horses:—

| | | | |
|---|---|---|---|
| One six-horse engine and boiler, with fittings complete | £200 | 0 | 0 |
| One dynamo-electric machine (Siemens), with lamp, conductors, and fittings complete | 150 | 0 | 0 |
| | £350 | 0 | 0 |

*Expenses of Working the Above.*

| | | | |
|---|---|---|---|
| Interest at 5 per cent. on £350 | £17 | 10 | 0 |
| Wear and tear at 10 per cent. on £350 | 35 | 0 | 0 |
| Fuel for engine, working for 1000 hours in a year, including loss incurred in getting up and letting down steam, at 1s. 6d. | 75 | 0 | 0 |
| Labour attending engine and boiler and lamp, at 1s. 6d. | 75 | 0 | 0 |
| Carbons, including waste, at 5d. per hour | 21 | 0 | 0 |
| Oil for electric machine, engine, &c. | 4 | 10 | 0 |
| | £228 | 0 | 0 |

Or 4s. 6d. per hour.

TABLE No. 2.

*Lighting by Gas.*

Cost of lighting Inspectors office with gas by means of four sun burners, consuming 540 cubic feet of gas per hour:—

| | | | |
|---|---|---|---|
| Four sun burners fitted complete, with electric apparatus for lighting same | £100 | 0 | 0 |

*Expenses of Working the Same.*

| | | | |
|---|---|---|---|
| Gas burning 1000 hours, 540,000 cubic feet, at 3s. 6d. | £94 | 10 | 0 |
| Wear and tear of burners, at 5 per cent. | 5 | 0 | 0 |
| Interest of capital, at 5 per cent. | 5 | 0 | 0 |
| Attendance for lighting, &c. | 5 | 0 | 0 |
| | £109 | 10 | 0 |

Or, say, 2s. 3d. per hour.

When the electric light is shaded by an opal glass, which is absolutely necessary to make the light at all endurable to the sight, one-half of it is lost; consequently, the whole cost of 4s. 6d. per hour falls upon one-half of the light available. This, of necessity, will bring up the cost to 9s. per hour, as against 2s. 3d., the cost of gas, or just four times the amount.

TABLE No. 3.

Should a gas-engine be employed, the following will be the approximate cost:—

| | | | |
|---|---|---|---|
| One six-horse gas-engine | £250 | 0 | 0 |
| One dynamo-electric machine, as above | 150 | 0 | 0 |
| | £400 | 0 | 0 |

*Cost of Working.*

| | | | |
|---|---|---|---|
| Interest at 5 per cent. on £400 | £20 | 0 | 0 |
| Wear and tear, 10 per cent. on £400 | 40 | 0 | 0 |
| Gas used, 40 feet per hour per horse power (40 × 4 × 1000) 160,000 feet, at 3s. 6d. per 1000 cubic feet | 28 | 0 | 0 |
| Labour attending engine and lamp | 50 | 0 | 0 |
| Carbons | 21 | 0 | 0 |
| Oil, &c. | 4 | 10 | 0 |
| | £163 | 10 | 0 |

Or 3s. 3d. per hour.

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## SUNDAY LABOUR IN GAS-WORKS.

At the Meeting of the Salford Borough Council last Wednesday—the MAYOR (Alderman Robinson) in the chair,

Alderman M'KERROW said he had a question or two to ask the Chairman of the Gas Committee. First, was gas made on the Sunday as on other days? If so, how many men were employed each Sunday, and how many hours did they work? Did the men so employed work every Sunday, or on alternate Sundays? Lastly, whether, in view of the recent decision of the Council not to open the free libraries and museums on Sundays, the Gas Committee proposed to discontinue making gas on Sundays, as it was evident such a practice was, in the opinion of the majority of the Council, inhuman and sinful?

Alderman SHARP, in replying, said gas was made on Sundays. The number of men employed was 118, and on week days 460. The men worked alternate Sundays.* The subject of the last question had not been discussed by the Committee, and he was not prepared to state what they proposed to do; nor could he say whether they and the Council considered it either inhuman or sinful. As far as he was concerned, he did not think it either inhuman or sinful. It was a work of necessity; at least, it was so at present. Besides, they were bound by Act of Parliament to keep up the supply of gas on Sundays as well as on week days; it was only a question of degree as to how much labour could be dispensed with on the Sabbath. The Gas Engineer (Mr. Hunter) had not overlooked the matter, and he said it was his intention to reduce the Sunday labour to a minimum, but he would be better able to do that when more complete apparatus was obtained, and when the new gasholders were completed. About spring, Mr. Hunter hoped to stop making gas from six a.m. to six p.m. each Sunday. That was done for a short time during one summer; but, under such circumstances, he was compelled to keep ten men at work to attend to the furnaces, and for other purposes. These men could not be dispensed with.

Mr. ASHWORTH gave notice that he should move at the next meeting—"That the Council, having recently expressed a pious horror of unnecessary Sunday labour, the Gas Committee be instructed to abolish it at as early a period as possible."

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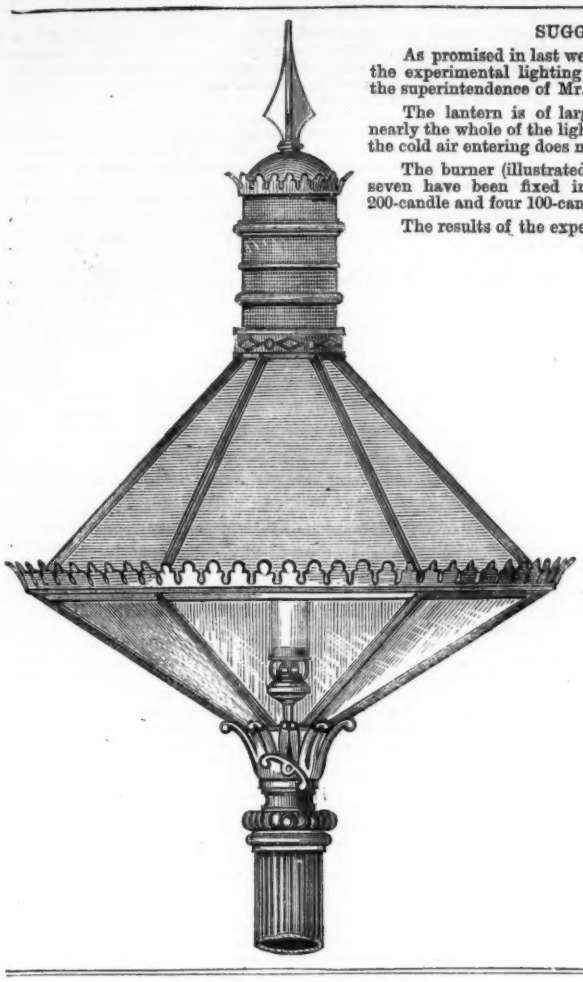
THE PROPOSED PURCHASE OF THE NEWINGTON (YORK) WATER-WORKS.—Last Tuesday evening a largely attended meeting of the ratepayers of Newington was held under the presidency of Mr. S. B. Whitaker, when Mr. S. Walliker moved a resolution to the effect that, in the opinion of the meeting the proposed purchase of the Newington Water-Works by the Local Board of Health, would entail a very heavy burden on the ratepayers, for which there was neither reason nor necessity, seeing that by a binding agreement with the Water-Works Company, confirmed by Act of Parliament, the district had secured a supply of water on reasonable terms for the next 14 years. Mr. Ross seconded the motion, and, after some discussion, in which Mr. Blackbourn, Mr. W. P. Garbutt, and Mr. Rayment took part, the motion was put, when 65 voted for and 11 against it.

WESTON-SUPER-MARE WATER-WORKS COMPANY.—The twenty-sixth annual general meeting of this Company was held on Saturday the 1st inst.—Mr. Alfred Hill in the chair. The report of the Directors stated that the net earnings of the year amounted to £2519 4s. 3d., making a balance on revenue account (including £303 7s. 8d. brought forward from the last account) of £2822 11s. 11d. applicable to dividend. Deducting from this the amount paid as interim dividend of 4 per cent. in October last, a balance of £1947 4s. 5d. remained. Out of this it would be proposed to pay 3½ per cent., to make up the statutory dividend of 7½ per cent. per annum on all descriptions of shares, and in addition to pay 11½ per cent. on the 900 old shares in reduction of the amount accrued in former years, during which either no dividend was paid, or during which the dividend was below the statutory rate. These latter payments, together with the interim dividend, raise the dividends on the old shares to 19 per cent. for the year. The Directors then say—"In the circular issued 23rd of October last, they reported that the Act of Parliament legalizing the sale of the Company's works to the Weston-super-Mare Improvement Commissioners would take effect on Dec. 26, 1878. On that day, therefore, the Directors handed over the Company's property to the Commissioners, receiving from them 1300 debenture bonds of £50 each, making a total of £65,000, as prescribed by the Act. The Directors feel that the town may be congratulated on having become the possessors of so prosperous an undertaking, while the Shareholders also have every reason to be well satisfied with the price obtained for them in exchange for their works, &c." On the motion of the Chairman, seconded by Mr. Hill, the report was adopted, and resolutions were carried declaring the dividends recommended in the report—6 per cent. to be paid to the original 900 shares at once, and the remaining 5½ per cent. on the same shares when the Directors had funds to do so. The meeting was then made special, and under the terms of the Act of 1878, debenture bonds were allotted in recognition of services performed as follows:—To the three Directors (exclusive of the Managing Director), £600; Managing Director, £745; Auditors, £60; Manager, £745; and Clerk, £350—total £2500. Thanks were accorded to the Commissioners and officers, and the latter were asked to retain office till the winding-up of the Company was completed. The meeting terminated with a vote of thanks to the Chairman and Directors.

* It was subsequently stated that Alderman Sharp, in saying that the men were employed on alternate Sundays, did not really mean that the men who worked the whole of one Sunday did no work at all on the following Sunday. It appears that those men who work from six a.m. till six p.m. on one Sunday, work the next week from six p.m. on Sunday till six a.m. on Monday morning.



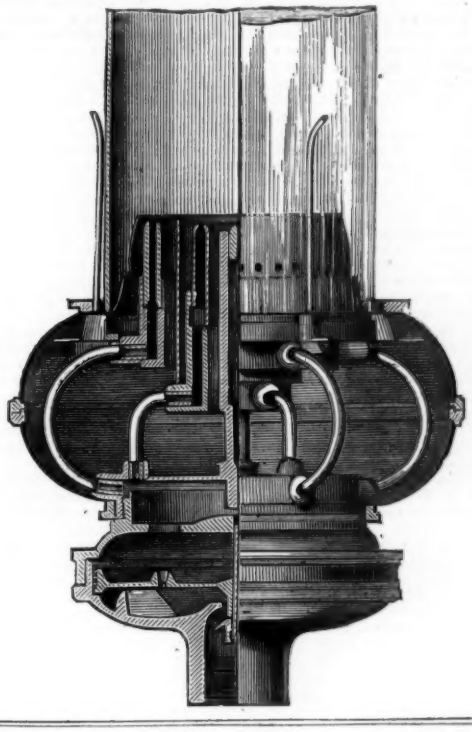
## SUGG'S IMPROVED SYSTEM OF STREET LIGHTING.

As promised in last week's JOURNAL, we give to-day illustrations of the burners and lanterns used in the experimental lighting of Waterloo Place and Regent Street by the Chartered Gas Company, under the superintendence of Mr. W. Sugg, of Westminster.

The lantern is of large size, and has clear glass below, but white glass above, in order to reflect nearly the whole of the light downwards. It is surmounted by a ventilating chimney, so arranged that the cold air entering does not interfere with the exit of the hot air at the centre.

The burner (illustrated part in section and part in elevation) is an 80-candle one, of which thirty-seven have been fixed in Waterloo Place and Regent Street, in addition to six larger ones—two 200-candle and four 100-candle, having four and three concentric flames respectively.

The results of the experiment were fully detailed in last week's number.



## SOCIETY OF ENGINEERS.

The First Ordinary Meeting of this Society for the present year was held on Monday evening, Feb. 3, in the Society's Hall, 6, Westminster Chambers, Victoria Street.

At the conclusion of the ordinary routine business, Mr. ROBERT PAULSON SPICE, M. Inst. C.E., M. Inst. M.E., Past-President of the British Association of Gas Managers, and who has been elected President of the Society for a second year, presented the premiums of books which had been awarded for papers read during the past session.

The PRESIDENT then delivered his Inaugural Address. He first expressed his thanks to the members for the honour they had conferred upon him in re-electing him President. After alluding to the progress of the Society, the work done by it during the past year, and its present satisfactory numerical, professional, and financial position, he referred to the general state of commercial depression, which so directly touched professional interests. Glancing, in passing, at the causes and results, he specially adverted to the circumstance, that some of the markets of the world—formerly open to our merchants and manufacturers—have been virtually closed to us by the lamentable return to the old system of so-called "protective duties," the application of which to our manufactures amounts to the positive prevention of the people from continuing to be our customers; their statesmen—blind to the best and lasting interests of the masses—having determined so to favour the few at the expense of the many, in utter disregard of the soundest principles of political economy. "Let us, however," said the President, "instead of croaking, stand up and quit ourselves like men, and especially as becomes Englishmen, leaving the people of less favoured nations to wrap themselves up in the worn-out and thread-bare vestments of protection." He then gave the following exhaustive *résumé* of the progress of electric lighting:—

The most prominently interesting scientific feature of the year has undoubtedly been the experimental introduction of electric lighting, on a more or less practical scale, in London and other places. There can be no doubt that undue prominence has been given to the question of electric lighting generally, which at the time led to equally undue alarm in the minds of those who are interested, as investors, in undertakings for the production of artificial light from other sources. It is not my province here to inquire into the cause which led to that undue prominence, nor to the motives which influenced the getting up of what was very properly called a "scare." It is sufficient for me to state the fact, which indeed must have been patent to every one who was able to think for himself, and capable of looking facts calmly in the face as they presented themselves to him. What I propose to do is to place before you particulars of such systems of electric lighting as have been introduced to public notice in a practical form during the past year, and to point out how far each has progressed towards practical utility.

In addressing you from this chair last year, I pointed out that the advance of illumination by the electric light during the preceding year had been very slight indeed. The only system which had been tried on anything like a working scale, was that of M. Jablochkoff, with which some experiments were made in the West India Docks during the preceding summer. So far as they went, these experiments were satisfactory, although they revealed several defects which have since been remedied, and have rendered the invention better fitted for practical purposes. I do not overlook the question of the cost of production, the consideration of which, however, I reserve for the present. The only other application of the electric light of a practical nature I then had to notice, was that of its use in photography, the light having been successfully utilized for this purpose by Mr. Van der Weyde, who still continues so to employ it. He has also contrived an adaptation of it for general illumination, in a manner which I shall presently describe.

During the past year electric lighting has been brought into extraordinary prominence by the experimental introduction of the Jablochkoff system into this country, by the development of a number of other systems of electric lighting, and by the exciting, inflated, and premature accounts of Mr. Edison's alleged discoveries, which, published primarily in a New York journal, were reproduced in the London daily press and in our Provincial newspapers, with such comments and embellishments as might be thought to assist the capacity of the credulous public, and which also served the questionable purposes of those not included under the above head.

A calm consideration showed that the exaggeration of manner adopted, covered some exaggeration of fact, and that Mr. Edison's discoveries—and promised discoveries, for the disclosure of which we are still waiting—owed much of their startling character to the peculiar style of American journalism. I do not for one moment desire to reflect upon Mr. Edison's character as a scientific discoverer; he has done very much towards the development of electric telegraphy and physical science generally. I do, however, seriously doubt whether Mr. Edison has done, or will ever do, so much as his enthusiastic friends, and the interviewing newspaper glossographers of the New York press, have given him credit for; and although he may have made, and may still be making great advances in electric lighting, neither I nor any one else can pronounce a positive opinion upon the inventions he is credited with, until we are made acquainted with their nature and details, for which we have now been waiting some months.

The most prominent of the various systems of electric lighting is undoubtedly that of Jablochkoff, which formed a great attraction in Paris during the late Exhibition, and down to the close of the year. The Avenue de l'Opéra, and some other leading thoroughfares, were illuminated by it, as were also several public and other establishments. The Jablochkoff light is now so familiar to most of us, that I need only describe it very briefly. It consists of a so-called electric candle, which is composed of two pencils of carbon connected together, side by side, by a strip of kaolin, which at the same time insulates them. The light is generated by a magneto-electric machine, producing alternating currents of positive and negative electricity. This light has been applied experimentally in London to a portion of the Thames Embankment, a portion of the Holborn Viaduct, and to the fish market at Billingsgate. It has also been applied in several large private trading establishments, and has also been under trial at Westgate-on-Sea. As the experiment on the Thames Embankment is the largest and perhaps the most important yet tried in England, a description of the arrangements, as there carried out, will prove interesting, and will afford a clear idea of the system. The portion of the Embankment lighted is that which lies between Westminster and Waterloo Bridges, and which represents a stretch of three-quarters of a mile. The experiments were undertaken at the instance of the Metropolitan Board of Works, and the arrangements were carried out under the direction of the Engineer to the Board, Sir Joseph Bazalgette, and their Consulting Chemist, Mr. T. W. Keates, and those gentlemen have, I believe, taken every precaution to render the trial an exhaustive one, and its results conclusive. The engine and machinery for generating the electric currents are placed in a wooden house, on the west side of the Charing Cross railway bridge. The conducting wires are led under the roadway to the subway, which runs under the pathway of the Embankment next the parapet

wall, and thence the wires are led to the lamps on that wall. The engine used is one of 20-horse power nominal, by Messrs. Ransomes, Sims, and Head, of Ipswich, and will indicate from 60 to 70-horse power. It is estimated that the engine is developing about 25-horse power, and will continue to do so during the present experiment, but this estimated power will, of course, be verified during the trials. The apparatus for producing the light consists of a Gramme continuous current machine, and a Gramme alternate current machine. The latter, which is of 20-light power, is divided into four circuits, each supplying five lights, and is excited by the continuous machine. The number of electric lights upon the Thames Embankment 20, is and the farthest lamp on the eastern, or the Waterloo Bridge side of the engine-house, is 470 yards from the apparatus, whilst the farthest lamp on the western, or Westminster Bridge side, is 700 yards from the machinery. The total distance between these two extreme points is thus 1170 yards, and the average distance between any two lamps is 45 yards, although some of the lamps are more distantly spaced. The ordinary gas standards have been utilized for the electric lamps, which consist of holders carrying four Jablochkoff candles, the holders being surrounded by opalescent glass globes 20 inches in diameter. Each candle is calculated to last an hour and a half, so that about six hours supply of light is ensured, without necessitating a replacement of the carbons, unless anything goes wrong, which it did on one of the first nights the system was tried, when, from a defect in one lamp, the rest on that circuit were extinguished, but were relighted as soon as the defect was made good. Each lamp has a commutator for switching another candle into position just as the preceding one is consumed, and thus each lamp is kept alight for about six hours each evening. But why this important experiment is thus curtailed, instead of being made complete by the lamps being kept lighted through the hours of darkness, as all the gas-lamps of the Metropolis and all large towns necessarily are, I cannot comprehend, unless it be for a reason which, when exposed and felt, would be fatal to the system—namely, the avoidance of the practical difficulty and expense of removing and replacing the burnt-out candles, which would in mid-winter require to be done twice in the night, involving the attendance of workmen, and the darkness consequent on the lamps in each circuit being out of use while the several lamps in that circuit were being thus refitted with candles. And this, it must be observed, is not merely a matter of expense which may be estimated, but it suggests a question as to the opportunity for committing evil deeds, thus afforded to the "powers of darkness;" and it is to be feared that the criminally disposed would not be slow to seize the opportunities which would thus be periodically afforded them to exercise their professional instincts.

The main points to be ascertained in these experiments are—firstly, the difference in illuminating power between these 20 Jablochkoff lamps and the gas-lights previously in use on the route; and, secondly, the cost. With regard to the first point, I may mention that the Embankment is about 100 feet wide, and there were three rows of gas-lamps, one row being that on the parapet wall, each lamp having two jets, the other two being those of the single-jet lamps on the edge of each pathway. The total number of gas-jets was 170. Now, each naked Jablochkoff light is estimated by its proprietors to be equal to 100 Carcel burners, each burner being equal to 10 candles. The electric lights should, therefore, equal 20,000 candles. Inasmuch, however, as the opalescent globe, by which the light is surrounded, is estimated to deprive it of 50 per cent. of its illuminating power, the light becomes at once reduced to 10,000 candles. Each of the 170 gas-burners was equal to 8 candles, so that the total illuminating power of the gas may be taken as equal to 1360 candles; but, as the sweetness of the rose is wasted on desert air, so is the radiant effulgence of these electric lamps, placed as they are on the parapet wall, in part lost by being wasted to the extent of another 50 per cent. on the adjacent watery highway, and this brings the total utilized illuminating power down to 5000 candles for the Embankment. But, as there is a proportionate waste of light from the gas burners in the intermediate lamps on the wall, which may be stated at 320 candles, the comparative results will be as follows:—

| | Candles. |
|---|---|
| Loss of light on river-side from the 20 electric lamps . . . | 5000 |
| Loss of light from the intermediate gas lamps . . . . . | 320 |
| Net loss or waste of light as compared with gas . . . . | 4680 |

involving the loss of the value of the light given by about 14,000 candles in a single winter's night, in lighting the roadway and footpath of that portion of the Embankment between Westminster and Waterloo Bridges, that quantity being wasted on the river—a result which would not be approved and sanctioned, as a permanent arrangement, by the ratepayers of the Metropolis, and which goes to show that the Embankment is not the most economical place in London for the exhibition of electric lighting.

But, leaving this last adjustment out of the question, the electric light should, on the data given, afford about eight times the light given by the gas. There is a undoubtedly a very great improvement in the lighting of the Embankment, but whether it amounts to the increased power which has been claimed for it, we have yet to learn from the report which will be made by the eminent Engineer, and the no less eminent Chemist, in whose hands the matter has been placed by the Metropolitan Board of Works. Meanwhile, the public are being treated to a display of this artificial, cold, moonlight illumination in conjunction with gas. The experiment was practically commenced on the 16th of December last, and will extend over three months from that time, or longer if found to be necessary.

The experimental trial of the Jablochkoff candle at Westgate-on-Sea was undertaken at the instance and the expense of Mr. Edmund F. Davis, of St. Peter's, Thanet, and to whom a large portion of Westgate belongs. The arrangements for, and the carrying out of the experiments were entrusted to Mr. W. H. Bennett, of Westminster, and Mr. W. A. Valon, of Ramsgate, both members of our Society. Six lamps were employed, placed 80 yards apart. They were similar to those on the Thames Embankment; so were also the general arrangements for producing the electric current, although necessarily on a smaller scale.

Here again, however, as on the Thames Embankment, the lamps were only kept going while one set of candles lasted in each, which, in this case, was four hours each night. This, in my opinion, is not satisfactory, as the test of a careful nursing of this method of lighting for four hours each evening cannot be considered conclusive as to its actual cost; for it is not at all clear that, to arrive at the true result, you have simply to multiply four by four to get at the difference of cost between four hours lighting and sixteen, which is about the time required for keeping artificial lights going on a winter's night; and the disturbing elements in such a matter as this are such, that, to determine finally and conclusively the question of exact cost, the practical difficulties should be encountered by actual working, and not be left to computation. The report of the two Engineers engaged on these experiments, which has been published in the JOURNAL OF GAS LIGHTING and in a separate form, is a valuable contribution to the literature of electric lighting, showing how the results brought out were arrived at, and enabling critics to test the conclusions, which are set forth in the clearest manner; leaving nothing to be desired but the solution of the question to which I have pointed attention—namely, if the cost of lighting a given number of electric lamps in an open thoroughfare—say, for five hours per night per annum—costs so much, how much will the cost per lamp be increased if the lighting be continued through each night, as is required in the usual way, making up the ordinary number of 4327 hours per annum?

An experiment so exhaustive as this could not be expected to be tried at the expense of a private individual, as were those at Westgate-on-Sea; but I cannot help thinking that, if any experiment was worth being tried at all by the Metropolitan Board of Works, it should have been an exhaustive, and not a tentative one.

The relative cost, exhibited in the report by Messrs. Bennett and Valon, of electricity and gas for public lighting, for a period of 24 days, four hours per day, equal to 96 hours, the quantity of light being equal in both cases, is £40 9s. 4d. for electric lamps, against £16 15s. 4d. for gas; the latter being for gas of practically 14-candle illuminating power, charged at 6s. 6d. per 1000 cubic feet; but if of the quality and price charged in London, the cost would amount to only £7 18s. 9d. This brings me to the consideration of the startling discrepancy between the estimated amount of light of the Jablochkoff lamp and the results brought out by actual measurement at Westgate-on-Sea—500 candle power being claimed, and 197 proved. And this appears to me to open up an important question for physicists and mathematicians, as to the apparent difference between the penetrative power of the electric light and gas light. The question has occupied my mind, but, at present, I have failed to devise a method of determining the *quantity* of the light, and can only say I suspect that the old law, of the illuminating power of light being as the square of the distance, will not apply to the electric spark; and I feel that we want to determine the difference in value between a light from a flame and that from a succession of sparks. In dealing with the practical experiment on the Thames Embankment, I have adopted the estimate of the *intensity* of the electric lamp, as given by its advocates, and am not disposed to challenge its accuracy; but let it be borne in mind, that *intensity* is one quality, and *quantity* another; and, as a practical man, concerned in the production of artificial light, I am of opinion that the electric light is inconveniently intense, and so deficient in volume, or quantity, as to be inapplicable to all the ordinary purposes for which artificial light is required, where economy is regarded.

With regard to the cost of the Jablochkoff light in England, no authentic particulars, so far as I am aware, besides those I have just referred to, are at present to hand. In France, however, especially in Paris, where it has been largely tried, the cost appears to have been ascertained in several instances. I am not able to vouch for the correctness of these figures, but have no reason to doubt their correctness, as they have been made public on the authority of Mons. J. Allard, the Chief Engineer of the Lighting Department of the City of Paris, and they refer to the application of the Jablochkoff system in the Avenue de l'Opéra. It appears that the Municipality of Paris paid the Société Générale d'Electricité 37 frs. 2 c. per hour for the 62 lamps in use there. These 62 lamps supersede 344 gas-jets, which were previously used, and which cost the Authorities 7·244 frs. per hour. The electric illumination, however, was considered as equal to 682 gas-jets, or about double the original illumination—that is, to a cost of 14·45 frs. per hour, as against 37·2 frs. for the electric light; the cost of which, therefore, is 2·6 times that of gas. The contract for lighting by electricity was terminated by the City of Paris on the 30th of November last, and the Authorities declined to renew it, except at the price paid for gas—namely, 7·224 frs. (or about 6s.) per hour, and that only until the 15th of last month. Those terms were accepted by the Société, so that the price paid to them was at the rate of about 1½d. per light per hour. I am informed that the Société place their expenses at 1·06 frs., or just 11d., per light per hour, so that the second contract could not have proved very remunerative. I understand, however, that, as far as the public thoroughfares are concerned, electric lighting has been discontinued in Paris.

The next system of electric lighting to which I shall direct your attention, is that of Mons. J. Rapieff, which was first brought into public notice during June last year. Mons. Rapieff's object was to produce an absolutely fixed point of light in connection with the subdivision of the electric light, securing perfect continuity of illumination, irrespective of the necessary renewal of the carbons, or of any accidental interruption of the current. This object he has succeeded in accomplishing. The light is produced from two pairs of carbons placed one above the other, the upper pair being inclined towards each other in V form, and the lower similarly inclined, but in Λ form, the point of ignition being the junction of the two points of the V's. The carbons are carried in fixed holders, and they are kept in juxtaposition by means of a light endless cord, on which is suspended a weight, the cord passing over a small pulley attached to each holder. If anything occurs to break or interrupt the current, a small electro-magnet comes into operation, and instantly re-establishes the light. The change of carbons is effected without breaking the continuity of the light. By withdrawing the remaining portion of one nearly consumed carbon at a time, and replacing it with a new rod, no interruption ensues, as the voltaic arc is maintained between the points of the three remaining carbons. The current may be supplied by a Gramme machine, giving either continuous or alternating currents. The simplicity and distributing character of this light led to its adoption in the printing office of *The Times*, and for some months past that paper has been printed by this electric light. Six lamps have been found sufficient to light the large room which contains the whole of the Walter printing presses employed in producing the daily issues of that journal.

Before noticing the next development in electric lighting—which is the Lontin light—it is necessary that I should refer to the Serrin and the Siemens lamps, because the Lontin light is a modification of the former. The Serrin lamp is one of those few in which only a single light is produced, the shortening of the carbon electrodes by combustion being followed up by means of a complex train of clockwork. The light is produced from a Gramme machine, giving continuous currents. The single light afforded answers the purpose of lighthouse illumination, and is suitable under other isolated or special conditions, although the apparatus possesses defects which are well known, and which are quite irrespective of its inapplicability to the purposes of subdivision of the electric light. The Siemens lamp is similar in principle to the Serrin, inasmuch as it only produces a single light, and the space between the carbons is maintained by the aid of machinery, although of a much more simple character than that of the Serrin lamp. Should the carbons approach too closely, they are separated by means of an electro-magnet, which is made to act upon the mechanism of the lamp, so as to restore the voltaic arc. The current is produced by a Siemens dynamo-electric machine. This system of electric light is in extensive use for lighthouse and other similar purposes, but Dr. Siemens proposes to utilize it for street lighting, by placing the lamps about 100 yards apart, and at high elevations. Each lamp would be covered by a metallic reflector, so shaped as to diffuse the light over a considerable length of a street, without throwing any against the fronts of the houses. But this may be regarded as "a dream and nothing more."

To return to the subject of the more recently developed systems, the next in chronological order, as regards its introduction to the British public, is the Lontin light, to which I have previously referred. For some months during last year, passengers through the Strand had an opportunity of

observing this light exhibited at the Gaiety Theatre, and I am not aware that it has been applied elsewhere in England. The light is produced by a modification of the Serrin lamp, and the current is obtained from a Lontin machine producing alternating currents. The system is limited to a productive capacity of two lights per circuit, and three circuits per pair of machines. These lights are still in use outside the Gaiety Theatre. This system has been applied to the stations of two railways in Paris, with satisfactory results. In 1877 a series of experiments were carried out with it at the Paris Terminus of the Paris, Lyons, and Mediterranean Railway. The passenger station was lighted, and the results proved so satisfactory, that the Company entered into a permanent contract with the proprietors of the Lontin light for lighting their Paris goods station with twelve lights, at a charge of 5d. per light per hour. The Western of France Railway Company have had six Lontin lights in the goods station at the Paris Terminus, St. Lazare, since May last year, and twelve lights in the passenger station since June. Careful experiments showed the cost there to be 8d. per light per hour, inclusive of interest. I am not acquainted with the conditions under which these lights are produced at the two stations, so I am unable to account for the difference in cost. It is clear, however, that it costs the Western of France Company 3d. per light per hour more than the Paris and Lyons Company have to pay for the same thing.

The next system for notice is the Wallace electric light, which is the invention of Mr. W. Wallace, of Ansonia, Connecticut, and which was first shown in England, in the early part of October last, by Mr. Ladd, the well-known philosophical instrument maker. The lamp consists of a light metallic frame, carrying two plates of carbon, each 5 inches long by 4 inches wide, the upper or positive carbon being ½-inch, and the lower or negative ¼-inch in thickness. The carbons are held endwise, one above the other, one being fixed in the lower part of the frame, and the other being free to move vertically above it, guillotine fashion. On the top of the frame is a small electro-magnet, which carries on its armature an ingenious and simple clutch, which grips a brass rod connected to the frame of the upper carbon. While the current is off, the carbons rest one on the edge of the other, but directly the current is switched on, each lamp in circuit adjusts itself. The magnet, becoming active, raises its armature, which, gripping the upper carbon holder, raises the carbon sufficiently to establish the voltaic arc. This arc or point of light travels gradually from one end of the edges of the carbons to the other, until so much has been consumed that the distance between the carbons is too great for the current to bridge over. The current thus being cut for an instant, the magnet ceases to hold up the upper carbon, which falls through gravity, and, on making contact, instantly resets itself. The point of light then travels back to the other end of the plates, on reaching which the operation of resetting is automatically repeated; and so on, so long as the carbons last, which is estimated at 20 hours. The light of each lamp is estimated to be about 800 candles, and the cost of the carbon in each lamp is placed at ½d. per hour. The machine by which the current is generated for these lamps is the Farmer-Wallace dynamo-electric machine, which produces a continuous current, and is capable of supporting a number of lights in one circuit, according to the amount of power absorbed, which is calculated at one horse per light, and about one for the line. The machine, being duplex in construction, can be used as two distinct machines, giving two separate circuits. It is this machine with which Mr. Edison has been carrying out his experiments in electric lighting, and it is much in favour in the United States.

The Wallace light is now under trial at the Liverpool Street Station of the Great Eastern Railway, where it has been applied to the upper ends of two of the platforms. There are three lamps on each platform, and they are placed 37 yards apart. The lamp standards are 20 feet high, and the electric lamp is contained in a plain glass lantern, of the inverted bell pattern. The current-producer is a Farmer-Wallace machine of 10-light power, and is placed in a temporary building at the far end of the platform, and one-eighth of a mile from the farthest lamp, the circuit wire being a quarter of a mile in length. The machine is driven through countershafting from a Robey engine of 10-horse power nominal. That portion of the station in which the electric lamps are placed is undoubtedly well lighted, but the brilliancy of the light is rather intense at first, owing to the transparent nature of the glass used. The eye, however, becomes accustomed to the light in a short time; but whether this would in time be at the expense of vision I am not prepared to say. It is a question whether a slight toning of the glass would not be an improvement. It is true, the lights are 20 feet high, and therefore comparatively out of the line of near vision. But this great height reduces the illuminating power of the light as regards the platforms; and, on carefully observing it, I came to the conclusion that the modification desired would be best attained by placing the lamps at a lower level, and using tinted-glass lanterns or globes. But it is very doubtful if, after all the modifications and improvements which may be practicable, such a light can be considered safe or desirable for such a station, with its enormous traffic, for there is no calculating the mischief—calamity, indeed—which might ensue in the event of the sudden extinction of the lamps—a contingency to which all electric lights are peculiarly liable, as proved by experience upon the Thames Embankment, the Viaduct, at Westgate-on-Sea, and elsewhere.

The Werdermann electric light was brought into notice early in November, by Messrs. J. Berger Spence and Co. Unlike most other inventions in this direction, Mr. Werdermann does not deem it essential that a certain definite distance should exist between the carbon electrodes. He, therefore, discards the voltaic arc, and places his carbons in actual contact, thereby producing a steady light by incandescence. This light is produced by a rod of carbon, which impinges upon the face of a disc of the same material, forming the negative of the lamp. The disc is placed at the top, and is about 2 inches in diameter and 1 inch thick, the under side being convex. The rod is about ½-inch in diameter, and is held vertically under the disc in a guide or collar, and its lower end is fitted in a small cap or holder, to which the ends of a fine cord are attached. The cord is led over pulleys and down to a counterbalance weight, and so acts in keeping the upper points of the carbon rod gently pressed against the under side of the disc. By this means the consumption of the rod is uniformly followed up. A small Gramme continuous machine supplied a current to ten of these lamps in the same circuit. A conducting cable was laid on from the machine to the row of ten lamps, and from it ten wires were led up, one to each lamp. The current passes from the lamps by a return wire to the machine. The light produced was steady, but small, and of moderate intensity. I am not aware that the Werdermann light has as yet been adopted on a practical scale.

I have already referred to the Van der Weyde electric light, which was first publicly exhibited in Regent Street, at Mr. Van der Weyde's studio, amid the blaze of gas illumination on the last anniversary of the birth of H.R.H. the Prince of Wales. This light is ordinarily utilized by its inventor for photographic purposes, to which he was the first to apply it. It is not, however, the production of the current, nor the means of converting it into light, at which Mr. Van der Weyde has laboured, so much as the rendering of the light produced available as an illuminator, without wasting it, so to speak, and yet without throwing the rays directly up on the object to be illuminated. This he accomplishes by using the carbon rods as electrodes, placed vertically one over the other, the upper rod being ½-inch, and the lower ¾-inch in diameter. These are placed near the mouth of a concave reflector; but none of the rays of light reach the spectator direct, as they are intersected by a disc of opal glass about 4 inches in diameter. The whole body of the light is gathered up in the reflector, and thrown out in a flood of pure white light. The current is produced by a Siemens dynamo-electric machine giving continuous currents, and driven by a small Otto gas-engine. So far as I am aware, the Van der Weyde light has not yet been applied to purposes of general illumination.

The most recently developed system of electric lighting is that of Mr. Henry Wilde, of Manchester, which was first exhibited towards the end of December last. This apparatus consists of an electro-magnetic induction machine producing alternating currents, and a carbon-holder or lamp of simple construction. The machine is the outcome of several years of patient study and practical research, having passed through many stages since the first one of its kind was exhibited by Mr. Wilde before the Royal Society some twelve years since. It consists of a disc of cast iron, which is mounted on a horizontal driving-shaft. Attached to the disc, and projecting from either side of it, are ten cores or armatures, while on either side of these again, are ten cylindrical electro-magnets, which are fixed to the side framing in line with the iron cores on the disc. The two circles of magnets consequently have their poles opposite each other, with the disc and its circle of iron cores revolving between them. The machine is of 10-light power, and the current from it is led away, by conductors, to the lamp in the usual manner. The light is produced by means of a pair of carbon rods placed side by side in a pair of holders parallel to each other, in a vertical position, with a space of about ¼-inch between them. If this space was filled in with an insulating material, a Jablochkoff candle would be produced; but it is not, and on producing the electric light from the ends of these carbons, they burn steadily down until they are wholly consumed. By means of an electro-magnet, the automatic lighting of the carbons is ensured, and the extinction of any of the lights on the circuit, by the interruption of the current, prevented. The experimental trial of this light fully demonstrated these points, and showed that a good light was produced, capable of being utilized for purposes of illumination. It may be its introduction has been too recent to allow time for its practical application; at any rate, I am not aware it has been so applied.

I have now placed before you the various systems of electric lighting which have been brought prominently before the public during the past twelve months. In addition to these, there are several which have been heard of, but never seen, and which it would be waste of time to discuss. I need hardly say that the records of the Patent Office showed last year a great increase in the number of applications for patents in respect of electric lighting over previous years. During the year 1877, although a large amount of interest was evinced in electric lighting, only 16 patents were applied for in this connection, while last year the number reached to nearly 100. From what I have said, it will be seen that there are at least nine systems of electric lighting for the public to choose from, all of which are more or less applicable to purposes of general illumination. As a matter of fact, however, besides the Serrin and the Siemens systems, which are in general use for lighthouse purposes, only one other has ever been tried experimentally for public lighting—I mean the Jablochkoff; whilst the Rapieff and the Wallace systems have been utilized, each in one instance only, and those for purposes more or less private, and this in the face of the alleged enormous demand for the electric light of which we heard so much a few months since. The fact is that people are, very sensibly, waiting for the results of the practical trials now being made by public bodies, and to which I have referred. These results, which, we may assume, will be thoroughly reliable, so far as they extend, will show the exact cost of electric lighting as against that of gas, and all public bodies and local authorities will then be able to see whether they can afford the great extra cost, which, up to this time, experience has shown attends its employment. There can be no doubt but that, for special purposes, as in *The Times* printing-office, where a high standard of illumination is a *sine quâ non*, and where the additional expense it entails is of no moment, the electric light will find a wide field for its adoption. Vestries, however, will find it a less easy question to solve; for, however much the British public may like to promenade by the light of electricity, they will object to pay for the extra illumination if it entails extra cost, and vote it to be, for the present, mere "moonshine," notwithstanding the fact that, in popular estimation, the electric light has come to be regarded in our day as the "light of the future," as no doubt, in some sense, it may be. But there is all the difference in the world between the proximate and the far distant future, and the apologists for an electric light have never defined this difference. Hence the British public are left to the exercise of their own imaginations, as to whether the electric light future may be five or five thousand years; and it would be presumption on my part to pretend to draw the line between these two periods.

I have occupied your attention thus largely with the question of the electric light, partly from necessity and partly from choice. From necessity, because it has formed the leading—almost the only subject of scientific interest and development during the past year; and from choice, because I desire to place on record, in our Transactions, such practical facts as are obtainable on this interesting subject. These may possibly prove of service, and to the convenience of future investigators in this direction, both as a guide and a warning. There is reason for believing that the science of electric lighting is far from fully developed, and that it has an important sphere of usefulness before it. But I believe its usefulness will not be so universal, nor its future so immediate, as its sanguine advocates think; nor, on the other hand, am I of opinion that its usefulness will be so very limited, and its future so utterly remote, as some of its opponents hope. It will find its present uses, as I have already said, where expense is a secondary consideration, and will almost certainly lead to a more liberal use of the well-established and less costly means of illumination by gas, which, in my opinion, will always hold its own. It is a singular fact, and one which has been commented upon lately by physicists, that this electric light outburst is coincident with the period of solar spots, through which we are now passing, and that it has been so before. Touching these sun spots, I may observe that they are supposed to be rents in the solar photosphere, caused by a violent up-rush of solar gas. It is also assumed that the darkness of these spots is occasioned by the in-rush of the corresponding counter-current from the colder solar atmosphere, and the consequent decrease of radiation on that side of the rupture. These periods of sun spots occur every ten years, and it is a very remarkable circumstance, that the electric light panic occurs coincidently with those periods. It is further stated, by those who are close observers of these signs of the times, that the period of maximum excitement corresponds precisely with the years of minimum spots. I do not attempt to explain this curious concatenation of circumstances, but there is at least one thought which forcibly suggests itself to my mind in endeavouring to reconcile these facts, and that is, that besides solar, there may also, in the recent periods of temporary depression in the value of gas property, have been *lunar* influences at work in our midst during the year.

The address was well received by an appreciative audience, and at its close a cordial vote of thanks was accorded to the President

## BIRMINGHAM CORPORATION GAS SUPPLY.

**At the Quarterly Meeting of the Birmingham Town Council last Tuesday—the MAYOR (Alderman Collings) presiding—the report of the Gas Committee, of which the following is a summary, was taken as read:—**

The Committee reported that a deputation from the King's Norton Rural Sanitary Authority attended one of their meetings, with reference to the supply of gas to Northfield. The deputation had no proposal to make with regard to the offer made to them, and the Committee were now taking steps to oppose the Bill which that Authority were promoting.

The maximum weekly and daily consumption of gas in the Birmingham district had recently increased so rapidly that the demand had overtaken the means of supply at the Committee's disposal. During the last three years the increase in the greatest weekly make of gas at the Birmingham works had been equal to about 6½ per cent. per annum compound, and, assuming that a like increase would take place in the winters of 1876 and 1880, it would be necessary to provide, in the next two years, additional manufacturing power to meet this increased demand, and which the Committee estimated at about 16 million cubic feet on the maximum weekly sale. In the districts supplied from the West Bromwich works the increase had not been in the same proportion, but the Committee had ascertained that if the present rate of increase at those works was maintained during the coming year, no material assistance could be obtained from them for the supply of the Birmingham district during next winter.

The Committee had given very careful attention to this question, and they were of opinion that, in the first place, the extensions partly made at the Saltley works should be completed immediately. In carrying out the extensions at those works which were authorized by the Council, the new buildings were so arranged as to render available for manufacture the whole of the site on the east side of the Midland Railway, and those buildings were designed to received additional plant from time to time at the least possible cost, until their greatest manufacturing capacity was reached. Although it would not be possible to provide on the present works at Saltley the whole of the extensions now required, it was obvious that the most economical course would be to complete the works which had been begun there, so as to obtain the greatest return from the capital already expended.

They recommended that they be authorized to obtain tenders, and to make contracts for the following plant, to be charged to capital account:—1. Additional retorts to fill up new retort-house. 2. Additional exhauster, condensers, scrubbers, purifiers, and revivifying apparatus, proportionate to the proposed increase of retorts. 3. Additional boiler-house and boiler. 4. Additional station-house and meter. They estimated the cost of those works at about £25,000, and the addition to the maximum weekly make at 10 million cubic feet. The extensions would meet the greater part of the demand which had to be provided for, and the Committee had under consideration the best method of providing at the Windsor Street works the further extensions for about 6 million cubic feet maximum weekly make, which would still be required. They were not, however, yet prepared to report fully on this subject. It would be necessary, during the coming year, to renew a portion of the plant at the Adderley Street works.

The Committee had been in communication with the West Bromwich Commissioners as to applications for extensions of mains which had been received from owners of property within that district. The Committee had expressed their willingness to make the extensions, if the Commissioners would undertake to pay the Corporation the cost of them, in addition to the amount to be paid under the award on the transfer of the undertaking. The Commissioners having refused to agree to the proposal, the Committee were, for the present, compelled to decline all applications for extensions within this district.

The attention of the Committee had been directed to the improvements which had recently been made in the means of lighting streets and open spaces with gas. They were now making experiments, with a view of bringing some of the improvements before the notice of the ratepayers, and they asked the Council to authorize them to undertake, at the cost of the Gas Department, the public lighting of New Street by those improved methods as an experiment. They did not propose, if the authority was given them, to interfere, in any way, with the lighting of the streets, as controlled by the Public Works Committee. They proposed to supplement this lighting in such a manner as to show the capabilities of gas illumination when effectively employed.

In consequence of the largely-increased make of gas, and also of the temporary suspension of the deliveries of coal over the Midland Railway during the guards strike, they deemed it advisable to purchase 27,000 tons of coal, to be delivered over the London and North-Western and Great Western Railways, during the present and preceding months. Notwithstanding the disadvantages of buying coal at this season of the year, they had been able to make those contracts on favourable terms.

They were of opinion that it would be a matter of interest to many of the ratepayers if opportunities were afforded to them of visiting the works, and of learning their extent, and the nature of the operations that were carried on in them. They therefore proposed that the Saltley and Windsor Street works should be opened to the inspection of the ratepayers, under suitable arrangements as to hours and the number of persons to be admitted at one time, on the first Wednesdays in the months of May, August, and November. It would be possible to admit about 550 persons at the two works on each of these days, and the Committee proposed to offer the tickets of admission for the first Wednesday in May next to the members of the Town Council for distribution.

The total quantity of coke in stock at the various works on Dec. 31, 1878, was 34,203 tons, as against 26,263 tons at the corresponding period of 1877. While the Committee regretted that the demand for coke in the iron trade had been for a long time past constantly diminishing, and was now probably much smaller than at any former period, they were glad to be able to report that their efforts to promote the sale of coke for domestic purposes had not been altogether unsuccessful. The demand for those purposes was steadily increasing, and the Committee were not without hope that a demand might ultimately be created in this, as in other towns, which would go far to relieve them from the difficulties with which they had hitherto had to contend. The Committee had recently tried, at the Windsor Street works, the experiment of selling coke in small quantities, at 3d. per half hundredweight, and they found that, in a few weeks, a large sale in this way had been established. On Saturday last upwards of 900 half hundredweights were sold, and the Committee were now making arrangements to establish this retail trade at the other Birmingham works. They were also endeavouring to establish a similar trade in other parts of the town.

The sale of gas for the year had been 2,494,495,900 cubic feet, as against 2,380,217,800 cubic feet in the year 1877, being an increase of 114,278,100 cubic feet; but, after deducting 25,046,000 cubic feet from the sale of 1877, being the sale to Walsall in that year, and which had now ceased, the increase in the districts now supplied had been 139,324,100 cubic feet, or at the rate of 6 per cent. The number of new services laid during the year was 2912, as against 3371 in the year 1877. 201 official tests of the illuminating power of the gas were made during the past year, the highest being 18·56, the lowest 15·79, and the average 17·27 candles, being about 2¼ candles in excess of the parliamentary standard.

The net profit for the year amounted to £54,831 17s. 8d., and a sum of £4104 11s. 4d. had been appropriated to the sinking-fund for the redemption of loans and annuities, making a total sum of £12,349 9s. to the credit of this fund. They recommended that the balance of the profit and loss account should be appropriated as follows:—viz., £25,000 to the borough-fund; £7152 2s. to the reserve-fund, making up this fund to the sum of £50,000, as authorized by the Act of Parliament; and the sum of £22,679 15s. 8d. to be added to the sinking-fund, which would then amount to £35,019 4s. 8d. The Committee had informed the Finance Committee of the Council that they hoped to place £25,000 to the credit of the borough-fund in the present year. The total amount of unpaid accounts and arrears available for collection on the 31st of December was £6033 13s. 11d., as compared with £8473 14s. 5d. at the corresponding period of 1877.

In fulfilment of their promise to consider the question of the reduction of price when the annual accounts were completed, they had given their attention to this matter. Looking to the favourable results of last year's trading, and to the favourable contracts for the sale of residuals which were now coming into operation, they were justified in asking the Council to sanction a reduction of price. They, therefore, recommended that a reduction of 3d. per 1000 cubic feet should be made to all consumers, to take effect from the beginning of the current quarter's accounts.

Alderman CHAMBERLAIN, M.P., moved—"That the recommendation of the Gas Committee, that the balance of the profit and loss account shall be appropriated as follows, namely:—£25,000 to the borough-fund; £7152 to the reserve-fund, thus making it up to £50,000, as authorized by the Act of Parliament; and £22,679 to be added to the sinking-fund, which will then amount to £35,029, be and is hereby approved." He said he should follow that resolution by a second one, to the effect—"That the Gas Committee be authorized and instructed to cause a reduction in the price of gas, of 3d. per 1000 cubic feet, to be made to all consumers, to take effect at the beginning of the present quarter's account, in accordance with the recommendations contained in their report. It was with a feeling of real gratification, and with, he thought, some not unjustifiable pride, that he had to lay before the Council the facts and figures upon which these satisfactory recommendations were based. In the course of the last three years that they had had experience of the control of this vast undertaking, he had seen with pleasure his most sanguine anticipations confirmed, and even surpassed, by the actual profits achieved. He hoped to be able to prove to the Council that great and substantial advantages had been derived by the town and by the gas consumers from the corporate control of the gas undertaking, and that there was every reason to believe that still greater benefits would flow in the future from the same causes, and that the courage of the Council, in undertaking, as they did, this new and vast responsibility, and the increasing care and assiduity of the Gas Committee in their supervision, had been followed by a full, a sufficient, and an assured reward. He thought there were few private ledgers in Birmingham which, in regard to the transactions of the last twelve months, would show results so satisfactory as the accounts he had to submit. The real attraction of the whole statement was to be found in the fact that a net profit of £54,831 had been realized in the past year. In 1877 the profit was £36,684, or £18,000 less; and in 1876 it was £34,122, or £20,000 less. They might, therefore, congratulate themselves upon the evidence of a steady and increasing prosperity. But the figures to which he had called attention did not represent the whole value of the undertaking. Before the Committee arrived at the net profit, they had struck off the sum of £4104, to be added to the sinking-fund, and also a sum of £10,000 in view of an approximate abandonment of the Fazeley Street works, which he hoped would be completed during the present twelve months. Adding these amounts, they would find the gross profit of the year was no less than £68,935. Even to that sum he might make many additions, in the shape of depreciations and expenditure, in substitution of old plant and in improvements of existing plant, which the Committee thought it their duty to carry to revenue, and not to capital. In the same period, the sale of gas was 2,494,495,000 cubic feet, against 2,380,217,000 cubic feet in 1877, and it showed an increase of 114,000,000 cubic feet. Then, if they allowed for the detachment of the Walsall portion of the undertaking, which was completed in July last, and which accounted for 25 millions of the sale, they would find that the total increase in the district supplied by the Birmingham Corporation was 139 million cubic feet, or 6 per cent. upon the year. The average of increase, however, had varied very much, especially in respect of the last quarter, the increase for which was at the rate of 8 per cent., as against 5 per cent. for the two preceding quarters, and 3 per cent. for the first. The recent cold and dark weather accounted for the improved increase in the latter period; but the cold weather was not an unmixed advantage, for it had the effect of condensing the gas, so that when it reached the consumer it had less measurable bulk than when manufactured. When the thermometer fell below freezing point, 1000 cubic feet of gas became only 950 cubic feet when measured at the consumer's meter. The Council would find in the report that the total expenditure up to Dec. 31, 1878, was £2,131,442. Three years ago, when they assumed possession of the works, the capital account was £2,000,931, the net increase being £130,511. The capital had increased 6½ per cent.; but in the same period the annual sale had increased 7¼ per cent., the maximum daily make 13 per cent., the storeage of gas 52½ per cent., and the freehold property of the Corporation in land held for the purpose of the gas undertaking had increased from 57 acres to 107 acres, or 87 per cent. There was also another way of looking at the question. All gas engineers of reputation agreed in a formula showing the amount of capital expenditure necessary to give a certain maximum daily make, and, applying that formula to the increase of make by the Gas Committee during the past three years—amounting to 1,900,000 cubic feet—they would find that the proper cost of works, after deducting the sum received from Walsall for plant, would be £145,000. Their expenditure, before making any deductions for depreciations and for sale of property during the year, was £162,000, or £17,000 more than the estimated cost of the increased daily make. The account, however, included extra storeage out of proportion to the maximum daily make, and which had cost about £50,000 above what would otherwise have been necessary. Upon this head of the account he ventured to say that the Council would find in the figures a certainty that the money which the Committee had been authorized to expend had been wisely and economically laid out, and that they had obtained far greater results than those usually obtained for similar expenditure, according to the experience of the best gas engineers of the kingdom. Referring to the revenue account, and comparing the last two years, he said he found that the increase in the consumption of gas accounted for an increase of revenue under that head of about £15,000. That increase appeared to have taken place among the largest consumers, the smaller ones having rather lowered their consumption. The cost of coal had been reduced by about £14,000, but this had been more than counterbalanced by the receipts from the sale of coke being lessened by £15,000. The cost of repairs and renewals at works had increased by about £10,000, while the cost of repairs and renewals of mains had been diminished by about £6000. At the works, great improvements had been made, the cost of which had been charged to revenue. The repairs to the mains had been diminished by the fact that the great work of re-arranging the whole system, which had been going on since the Corporation took possession of the undertakings, was now practically completed. The repairs and renewals of meters had increased by £4000, chiefly due to a new system of accounts, under which a larger proportion of those expenses were carried to the annual expenditure of the year than had heretofore been the case. It was the intention of the Committee to have a full stock-taking of all the property of the Corporation, both in regard to the meters, mains, and any other works; and when this was done, they would be able to see how far their estimate of depreciation of the sums carried to the cost of revenue was justified or not. He was glad to point out that, under the heads of "Law" and "Bad debts," the cost to the Corporation was much less during the present year than formerly. On the other hand, the rates and taxes had increased by £2000. The amount received from tar was about the same as in the preceding year; while the amount received for ammoniacal liquor was £12,000 more. Reverting to the net amount of £54,831, he found himself face to face with a question of the utmost importance to the Town Council and the borough. He asked, how had that profit been realized? There was a theory which had found much favour outside, and had one advocate within the Council itself. This he would venture to call the West Bromwich theory, because it had been adopted by the outside districts, in their endeavour to depreciate the value of the property which they had to buy; and that theory was based upon the argument, that, while coal had been reduced, the price of gas had not been proportionally diminished, and, therefore, the profits had been made by unduly taxing the consumers—in point of fact, making profits for the Corporation at the cost of the ratepayers. If that were true, it would certainly be a grave accusation against the honesty of the Gas Committee; it would be a miserable legerdemain, totally unworthy of men of business or of honourable public servants. It was a very simple theory, and the objection to it was that it was incomplete, inaccurate, and misleading. He would endeavour to prove this by two comparisons. He would first call attention to the state of things during the coal famine, when the prices of coal and gas were at their highest, and he would also inquire into the condition of affairs before the coal famine, when coal and gas alike were at their lowest.

In 1875, when the price of coal was highest, the cost of coal to the Gas Companies was 21·53d. per 1000 cubic feet; while at that time the amount received from the sale of coke was 8·65d. The net cost of coal, therefore, after deducting the price of coke, was 12·88d. per 1000 feet. During the last year—1878—the cost of coal was 15·07d., and the amount received for coke was only 3·85d. The net cost of coal was consequently 11·22d. The total difference, therefore, in favour of the Corporation, between 1875, when the price of coal was so high, and the present time, was only 1·66d.; and in that period a reduction had been made of 3d. per 1000 in the price of gas. So far as this comparison went, they were 1·34d. per 1000 better off than at the first-mentioned period. Returning to 1871, he found that coal was being purchased by the Companies at 9s. per ton, and, deducting the price realized for coke at the rate of 6s. 7d. for the product of each ton, the actual cost of the coal would be 2s. 5d. per ton. In 1878 the price of coal was 9s. 6d., and only realized 4s. 5d. for the product of the coke; therefore, the net cost of coal was 5s. 1d. per ton, or 2s. 8d. more than in the earlier period, which meant a sum of £40,000 to the Gas Committee, or equivalent to 4d. per 1000 cubic feet. The average price of gas in 1871 was 2s. 4d. per 1000, whilst the present average was 2s. 10d.; and, taking the coal alone into account, it followed that they were 2d. dearer than in the earlier period. But if the Council sanctioned the reduction in the charge for gas, they would be 1d. cheaper. There were other points, however, to be considered. For instance, the wages paid for the manufacture of gas rose 10 per cent., and had not subsequently been reduced. Putting aside these facts as of less importance, he wished to point out that, compared both with 1871 and 1875, the gas consumer in 1879 had every reason to congratulate himself. What they had to ask was—What would the Companies have charged if they had remained the sole manufacturers and suppliers of gas to the town of Birmingham? They had to imagine the Birmingham and the Staffordshire Companies both at work with their separate offices and staffs, double systems of mains, and all the expense which such a complication involved. In the first place, the gas consumers would have had to pay a sum of £6000 more to the Birmingham Company than the Corporation were paying in interest to their Shareholders. The Corporation bought the Birmingham Company at a time of depression, when they were not making their maximum dividend. They paid for that undertaking, roughly speaking, the sum of £18,000 per annum in perpetuity; but the maximum dividend of the Company upon their then capital amounted to £24,000 per annum, and there was not the slightest doubt that now they would be paying their maximum dividend. They had, therefore, saved £6000 by the terms of the purchase in the case of the Birmingham Company. Then there were the Directors fees, which amounted to £2000. He regarded that item with especial pleasure, because it was a clear saving to the town. Well, the difference in the interest which the Companies would have paid on the new capital that had been raised, the saving the Corporation had made on the old loans which had been renewed at the lower rates, and the tax upon the annuities paid by the Companies out of the profits and now paid by the annuitants themselves, amounted to another sum of £6000. The amalgamation of the two offices and of the staffs, the alterations made in the system of collection and in the commissions that had been allowed, the changes in the secretarial department, and the alterations of management, together with the reductions in the bad debts, produced by all these changes, amounted to not less than £10,000. The saving in the leakage, due to the re-arrangement and amalgamation of the whole system, amounted to not less than 2·5d. per cent., and was worth at least £5000. Lastly, there was the alteration effected in the old contracts in force in the time of the Companies, and which resulted in an additional profit of £1000 a year. Adding these sums together, they would find that £30,000 a year had been saved by corporate control, and by the management of the Gas Committee. These savings were not open to the Companies so long as they maintained their separate management. The cost of coal to-day was something like £50,000 per annum less than it was in the time of the Companies. Of course, the greater part of that difference was due to the fact that coal had fallen in price everywhere, and the Companies would have saved a very large proportion, if not the whole of that sum. In 1875 the consumption of coal was 296,000 tons, and from that the Companies made 2579 million cubic feet of gas. In 1878 the consumption of coal was exactly the same as in the former year, but the make of gas was 2755 million feet, or 7½ per cent. more. That was due to the improvements which had been made. He gave the credit, in the first instance, to the Engineers acting under their instructions. It was also due to the power which the Corporation had—and what the Companies, as far as he knew, had never possessed—of contrasting the result at the different works, week by week and month by month, thus setting up a sort of competitive examination between the Engineers, and obtaining the uttermost farthing which the concern was capable of producing. Although he did not deny that the Directors of the Companies might have done as well in some respects, he put it to the Council whether it was not likely that a considerable portion of that saving, at all events, might be due to the kind of management which was introduced by corporate control. But to what did the saving amount? The difference to which he referred involved an additional consumption of coal of 21,000 tons, and that, at the present price, would be worth no less than £10,000 per annum. Then, again, there was the contract for ammoniacal liquor of which he had spoken; the old contract, made by the Directors of the Staffordshire Company, expiring in July last year. They had made a new contract, and under it they had already received, in six months, £10,000 more than was previously received under the old contract. They expected in the ensuing year to have an advantage, from that cause alone, equal to £20,000 per annum. He believed that the contract they had entered into was the very best that had hitherto been obtained by any corporation or gas undertaking in the kingdom. Throughout every department of their work there had been constant progress and improvement, which had involved large savings of money, and he ventured to think he was entitled to ask the Council, in considering these savings, to distribute them between what was simply due to the altered circumstances of the time, and what was due to the ability and assiduity of the Gas Committee; and he hoped they would be rather generous towards them in so doing. He thought he had explained that the profit had not been made by a disproportionate price of gas as compared with the price of coal. He had shown them the source from which the profit had been derived. He wanted, for a moment or two, to call their attention to what was the greatest difficulty—the coke question. The difference in the sum which had been received for coke, as compared with the price obtained three years ago, was no less than £50,000 per annum. If they could obtain the same price which the Companies obtained for their coke, they could reduce the price of gas by 5d. per 1000 to-morrow, in addition to the 3d. they were going to ask the Council to authorize, and still show the same magnificent results. He thought the public at large had not appreciated the peculiar position of Birmingham with respect to the gas question. For years past it had been customary to regard Birmingham as most favourably circumstanced with regard to gas manufacture, and it was thought they ought to sell gas at a lower price than any other town in the kingdom. Many people imagined that Birmingham was in the centre of the coal district, but that was an utter mistake. They did not draw more than a very insignificant fraction of their coal supplies from the district in which Birmingham was situated. They had to go far afield for the kind of coal that would give them the best results. They had to go to Lancashire, Yorkshire, and Derbyshire; and North Staffordshire was really the nearest source from which they could draw any very great quantity of coal. They brought their coal to Birmingham from the immediate suburbs of Wigan, Leeds, York, Sheffield, Derby, and other places, which were, therefore, in a much better position than Birmingham, as far as coal was concerned, inasmuch as they in Birmingham had, in addition to the net cost of the coal, to pay for the carriage. In times past all these disadvantages were compensated for by the fact that Birmingham lay in the centre of an iron-producing district, and the great blast furnaces of Staffordshire took from the gas-works, at very remunerative prices, all the coke they could make. That was a state of things which, under the pressure of bad trade, had entirely disappeared, so that any comparison with past times was wholly futile, unless that very important change was taken into account. Reverting to the profit of £54,831, which they had made during the year, the question was, How should they dispose of it? By order of the Council they had already carried £25,000 to the rates of the year, and they proposed to make up to the maximum amount allowed by Act of Parliament, the reserve-fund of the undertaking, by adding £7152, which would make it £50,000. That was the best way in which they would be able to deal at any time with any unexpected emergency, or if any accident or calamity should befall the gas undertaking. That would leave them with £22,679 15s., and they proposed that that sum should be carried to the sinking-fund. They had already carried £4104 to that fund, and the total sum so carried would, if the Council accepted their recommendation, amount in the past twelve months to £26,784 7s. That was the matter which involved a principle of great importance, and he hoped the Council would pay the greatest attention to it. By the Act of Parliament, they were compelled to provide a sinking-fund, which would extinguish all their liabilities within 85 years. The Gas Committee thought the time had arrived when the Council should seriously look at the question again, and consider whether it would not be more prudent for them to face their liabilities in an attentive manner, and undertake to wipe off their indebtedness in a much shorter time than was allowed by Act of Parliament. The balance of their liabilities on Dec. 31 last was, as nearly as possible, £2,000,000. That would be reduced, supposing the Gas Committee came to a sudden termination, by the considerable sums they would have to receive from the purchasing districts. They did not know what they were going to pay them; but, in any case, these payments would be very large. The balance represented 107 acres of freehold land of great value, materials, buildings, a mass of iron, and other manufacturing plant, which, even at a break-up price, would no doubt give them a very large sum. He was glad to say that the investigations he had made into this particular subject showed that their total liabilities were in less proportion to their total receipts than was the case in any London Company with whom he was acquainted, and he believed they were below the average of the Provincial undertakings in the kingdom. He thought the town would support the Council in dealing boldly with this question; and they would feel more comfortable if steps were immediately taken to reduce these obligations. In the last few months they had passed through what was called the "electric light scare," and the shares of Gas Companies were temporarily reduced in value from 25 to 15 per cent. Supposing the first reports of Mr. Edison's discoveries had been true, the gas undertaking would have been virtually extinguished, and no one could deny that that would be a great calamity to the town, and not to Birmingham alone, but to almost every Provincial town of importance. But what were they to say of those persons who had been ignorant enough to believe those stories, and were wicked enough to gloat over what they called the impending ruin of the town in which they lived, and which had done so much for their comfort and prosperity? Fortunately, however, these predictions had been falsified. The Gas Committee had been thoroughly alive to the importance of the business, and they had had special reports made by their Engineers, who, for that purpose, had visited Paris and other parts of France in which the electric light was to be seen in operation. They had also made themselves acquainted with the details of the experiments which had been tried in London, and he would tell them the conclusions at which the Gas Committee had now arrived. They thought that so long as the practical development of the electric light was confined to the Jablochkoff and other candles, there was not the slightest chance of the electric light being substituted for gas, beyond acting as a healthful stimulus and competitor. One of these Jablochkoff lights was said to be of nearly 500 candles illuminating power, or equal to the power of 60 fishtail burners, averaging 8 candles each. But out of 63,809 meters which were in the possession of the Corporation, only 356 were in use for supplying 60 burners, and he did not believe that, of that small number, there were more than one-fifth or one-tenth employed in cases where the 60 burners were in use in one room. Of course, it was possible to utilize the electric light with considerable effect in such buildings as the Town Hall, picture galleries, and printing offices; but for general purposes there was not at present the slightest reason to fear that it would come into rivalry with gas. The latter, however, really had not had a fair chance. The Gas Committee intended to make great experiments to show what they were actually able to do, and they suggested that they should be allowed to try experiments in New Street, in a manner that might give general satisfaction. Their object would be, not merely to afford a greater amount of light, but to produce an illumination which should be an attraction and an ornament to the town, and a credit to, and an advertisement for the Gas Committee. How long such experiments, if they succeeded, should be continued, and to what degree they might be further extended, were matters upon which they asked for no opinion. He suggested that the sum to be carried to the sinking-fund should, in future, be not less than £25,000 per annum. If that were done, and reckoning the compound interest at 4 per cent., they would have nearly £1,500,000 sterling in the sinking-fund in 30 years, and by that time there would be removed everything like apprehension or alarm as to anything which scientific discovery might have in store for them. The Gas Committee thought the time had arrived when they might reduce the price of gas, and it was proposed that a reduction of 3d. per 1000 should be made, dating from the 1st of January last. That would cost the Committee £30,000 per annum. The profit for last year, as he had already stated, was £54,000, which, with the sinking-fund, came to £58,000. This, added to the receipts they would derive from ammoniacal liquor, which would increase the profits they would realize from the large sales anticipated, would bring the profits up to at least £75,000. Taking £25,000 for the rates, as usual, and assuming that the Council consented to a reduction equal to £30,000, it would leave £20,000 for the sinking-fund. But having regard to the steady progress of the undertaking, and that it was their desire to rather under than over-estimate their prospects, they were justified in asking that this reduction might be sanctioned, in the hope that at the end of the year the profits might be something better than they anticipated at the present time. Now, if the Council carried out that recommendation, the average price of gas in Birmingham would be 2s. 7d. per 1000 feet; and perhaps he should surprise the Council when he told them that the price would be lower than in all the other towns in the kingdom

except two. In making a contrast respecting charges for gas, it was necessary to take several points into consideration. In the first place, there was the price, and that should be reduced to the net and the average price. In the second place, there was the question of whether meter-rents were charged, and that was a most important element in the calculation. In nine towns, at least, out of ten, in addition to the price of gas, large charges were made for meter-rents, sometimes amounting to 2d. and 3d. per 1000 feet, and in some cases, he was told, they represented as much as 5d. per 1000. Lastly, there was the question of quality, which was also to be considered. The price of gas in Walsall was 2s. 3d. per 1000, or 4d. lower than the Birmingham charge; but that was entirely due to the fact that in Birmingham they were paying between 8d. and 9d. per 1000 feet as interest on their capital, while in Walsall they had made such reductions in this respect that the interest only amounted to something like 4d. or 5d. per 1000 feet. At Plymouth, gas was 2s. 6d. per 1000, but the quality of the Plymouth gas was 2 candles less than in Birmingham. In Birmingham they were paying at the rate of 4½d. per 1000 feet for their coal, in the shape of carriage from the Leeds coal district, and yet the selling price of gas in Leeds was a halfpenny dearer than in Birmingham; besides which, in Leeds they did not carry anything over to the rates, whereas in Birmingham they hoped for all time to appropriate £25,000 a year to that purpose. In the great majority of 38 towns, in regard to which he had been furnished with statistics, the price of gas ranged from 3s. to 4s. per 1000 feet, and generally with the addition of meter-rents. He ventured to say that, under those circumstances, the gas consumers of Birmingham had nothing to complain of. As reasonable men, they could not expect to pay the same prices which were charged seven years ago, when the iron trade was in full and vigorous operation, and which enabled them to get rid of their coke at remunerative prices. In three years they had carried £80,000 to the rates, £50,000 to the reserve-fund, nearly £40,000 to the sinking-fund, and in the same time they would have made two reductions in the price of gas, at a cost altogether represented by £60,000 per annum. The credit of this result was largely due —he was glad to admit it—to the efforts of the permanent staff of their great establishment. He desired, on behalf of the Committee, especially to express the satisfaction which they felt with their chief officials—with the Secretary, Mr. Edwin Smith, and with the Engineers, Mr. Charles Hunt and Mr. Harry Hack—who had brought to their work an amount of knowledge and zeal which was worthy of the highest praise. He hoped that, without an excess of vanity, he might say also that something was due to the constant and unremitting exertions of the Gas Committee. He could say truly that their labours had been very arduous, that they had been very anxious, and, in the case of some, at all events, they had only been performed under a deep sense of public duty, which had involved considerable sacrifice of personal interest and domestic ease. They now waited the decision of the Council as to whether the work he had described, and the results he had laid before them, were worthy of their approval and continued confidence.

Mr. Marris seconded the motion, which was carried.

Alderman Chamberlain then moved that the Gas Committee be authorized and instructed to cause a reduction in the price of gas, of 3d. per 1000 cubic feet, to be made to all consumers, to take effect from the beginning of the current quarter's accounts.

Alderman Baker seconded the motion, which was agreed to.

Alderman Chamberlain next moved—"That the Gas Committee be authorized to undertake, at the cost of the Gas Department, by way of experiment, the lighting of New Street by improved methods, during such a period and during such terms as they may deem advisable, in accordance with the recommendations contained in their report." He explained that they were unable at present to go into details respecting the proposed experiment. They did not propose to interfere with the lighting carried on by the Public Works Committee; it would be entirely an illumination carried on on their own account.

Mr. Cook seconded the motion, which was adopted.

Alderman Chamberlain proposed that the Gas Committee be authorized to enter into contracts for the construction of additional retorts to fill up the new retort-house, additional exhauster, condensers, and other necessary apparatus to be used therewith, and an additional boiler-house and boiler, station-meter and house, at an estimated cost of £25,000.

Mr. Austin seconded the motion, which was carried.

Alderman Chamberlain then moved the adoption of the report. As to the proposed opening of the works to the ratepayers, he had always said that the Council were really in the position of a great limited company, in which all the ratepayers, as a town, were shareholders. They wanted, as far as possible, to increase their interest in the undertaking—to make them feel that it was their property, and that the Council were merely their servants, as directing and managing on their behalf. They had thought it would be a pleasure to many to visit the works and see the manufacture being carried on there. If it should become evident that large numbers desired to avail themselves of the privilege, the Committee would endeavour to extend the opportunities they proposed to afford. He hoped that both proposals would commend themselves to the Council.

Mr. R. F. Martineau seconded the proposition.

Mr. Lawson Tait remarked that he was not so confident as Alderman Chamberlain that Mr. Edison's discoveries would not lead to something else. Still it was perfectly certain that the easiest method of getting the electric current for the purpose of making light was to employ a gas-engine, and, therefore, the more the electric light was used, the more gas would be used for the production of that light.

Mr. Whateley expressed his gratification at the report that had been presented, but said he should like to know whether it was true that the gas was not so good as formerly. There were complaints outside with regard to the quality of the gas, and also with regard to the increase in the gas bills.

Mr. R. Chamberlain moved, as an amendment, that the following words be inserted:—"And that a copy of the proceedings be printed at the expense of the department, and circulated among the consumers."

Mr. Tait seconded the amendment.

Alderman Chamberlain, in reply, said he was certainly desirous of giving to the ratepayers all possible information concerning the undertaking. Perhaps, however, the suggestion of Mr. Chamberlain would be met by allowing the matter to remain at the discretion of the Gas Committee. As regarded the matter of the increase in the gas bills, he might state that in the last three years the gas sales had only increased 7½ per cent., whereas the normal increase ought to have been 18 per cent., and, indeed, it was proceeding at that rate until bad trade came on. For one account that had increased out of proportion, there were a great number that had not increased, and had even diminished. The quality of the gas was, at the works, as high as ever; but it was undoubtedly true that it was, and had been during the cold weather, not so high at the consumers meters. That was not the Committee's fault. The cold weather had the effect of diminishing the illuminating power of the gas, and the Committee were no more responsible for that than was Alderman Avery, when one of hydrants happened to be frozen on the occasion of a great fire.

The proposition was then adopted, the report approved, and the Council proceeded to other business.

## NORWICH WATER-WORKS COMPANY.

The Half-Yearly Meeting of this Company was held on Wednesday, the 29th ult.—Mr. H. S. Patteson in the chair—when the following report was presented:—

The accounts of capital and revenue for the half year ended the 29th of September last, now read by the Secretary, have been investigated and audited, and found to be correct.

After payment of working expenses, debenture interest, and dividend on the preference shares, and including the balance from the previous half year, there remains a sum sufficient to pay a dividend of 6 per cent. per annum, deducting income-tax, leaving a balance of £995 10s. 3d. to the credit of the next half year's account. The Directors have, therefore, declared a dividend at that rate, which will be payable to the Shareholders on the 1st of January.

It is now 20 years since the last extension was made to the pumping-works at Heigham, and since that period the business of the Company has increased to a very large extent, and it has now become needful to considerably enlarge the works at this station. The Directors have, therefore, had plans and specifications prepared for the necessary works, and intend forthwith to proceed with the construction of the same, in order that the Company's plant may be kept equal to, and in advance of the requirements of the city.

The Directors who retire by rotation are R. N. Bacon, E. C. Bailey, and John Pymar, Esqs., who, being eligible, offer themselves for re-election.

The Chairman, in moving the adoption of the report, said the works of the Company were all in good order, and everything was satisfactory. He had noticed a letter in a newspaper, asking that the income-tax should not be deducted from the dividend; but the reply to this was, that the Company could only pay 6 per cent., and, if this deduction were made, they would be paying more than that sum. With regard to the works at Heigham, they had for some time been looking forward to extend and enlarge them, and it was necessary that they should now commence operations. Alluding to their second reservoir—which had recently been emptied, and which had been full for six years, containing 1,500,000 gallons of water—it was most satisfactory to find that there was not a single brick settled. This showed that the work had been well executed.

The report was then unanimously adopted.

The retiring Directors were re-elected, and W. Cubitt, Esq., was re-elected Auditor.

The Manager (Mr. John Ayris), in answer to a Shareholder, said he thought they were too small a Company to issue debenture stock, and it was much better to issue the bonds. Besides, they could not float debenture stock at 4 per cent.

Mr. T. Hawksley (the Consulting Engineer) also thought it was to the interest of the Company not to issue debenture stock, which was inconvertible, whilst in the case of bonds there was not that difficulty. Turning from that point to the works in Norwich, he said they were in excellent condition, and the water had been as good as it possibly could be. A remark had been made depreciatory of the quality of the water on a single day. That accusation had been brought in consequence of a mistake, or, in fact, two mistakes. Some persons seemed to forget that it was Nature, and not the Company, who really provided the water, and if there were little variations in the supply now and then, the public must kindly put up with them. After looking to the alleged analysis of the water on the occasion he mentioned, he found there must have been some great mistake, because it stated facts which could not go together. It stated an amount of hardness, and an amount of solid matter, which were impossible to exist one with the other. Then as to the amount of ammonia found. One part in eleven millions was discovered, and that of a matter which, in all probability, was perfectly innocuous; although, if it were the poison of the cobra, nobody would be any the worse.

A Shareholder asked whether anything was to be done with regard to the New Mills.

Mr. Ayris replied that the Company had a lease of the property, and they would not stand in the way of anything the Corporation might propose.

Votes of thanks to the Chairman, the Directors, and Mr. Ayris, closed the proceedings.

## THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

With the break-up of the winter, the coal trade of this district is gradually relapsing into the depressed condition by which it was characterized during the greater part of last year, and which there is every prospect will prevail during the ensuing twelve months. Although the exceptional severity of the last couple of months has enabled many of the colliery proprietors to fill up a good deal of the coal which was lying on their pit banks, there are still heavy stocks held at many of the collieries, and in some cases these are even larger than they were at this time last year, whilst many of the mines, chiefly those with low qualities of coal, which were closed last year in consequence of the absence of demand, and the unremunerative prices at which sales could alone be effected, are still laid off, as there is no indication of any improvement whatever in the demand for common coal for iron-making and steam purposes; and as soon as the requirements for house-fire consumption fall off, a great deal of common coal will again be thrown upon the market, whilst the better classes of round coal will naturally again accumulate in stock. There is, however, still sufficient demand for house-fire coal to maintain prices at about late rates, best Wigan Arley, at the pit mouth, being quoted at 9s. to 10s.; common and ordinary qualities ranging from 7s. to 8s. 3d.; good Pemberton four-feet from 7s. 6d. to 8s. 6d.; common round coal from 5s. 6d. to 6s. 6d. per ton, according to quality. Engine classes of fuel are, however, not quite so steady, and common classes of slack have to be pushed at very low prices. Burgy, at the pit mouth, ranges from 4s. to 4s. 9d., and ordinary slack from 2s. 6d. to 3s. 6d. per ton.

The shipping trade continues moderately active, with about late prices ruling in the market.

The iron trade continues extremely dull, and there is very little business of any description offering in the market, while prices for all classes of iron are lower than they have ever before been known in this district. Lancashire makers of pig iron are almost driven out of the market altogether by the keen competition of outside brands, which can be bought at fully 5s. per ton below the prices which local smelters are quoting. The finished iron trade is in a very depressed condition, and it is difficult to ascertain what prices are ruling, as special quotations would be made to secure good specifications, were any offering. The engineering branches of trade are in a more depressed condition than has ever before been known, and many of the largest works have not more than about one-quarter of their full staff of men employed, whilst in a proportion of the establishments only part time is being worked.

## THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

There was a fair amount of activity in the coal trade of the North of England last week, although there was probably not quite so much coasting business transacted. There was a falling off in the demand for household coals to London. The shipments of gas coals, however, were fully an average. The gas coal trade of the county of Durham is passing into a

new phase. The masters in the Durham coal trade are asking from the pitmen a reduction of 20 per cent. of wages all round. This they are not likely to get; but there will be a substantial reduction, no doubt. As we have reported in this column on several occasions, the leading business done in gas coals is decidedly for best qualities. Probably about half a dozen large pits do the most of the trade. These, as we have shown, have had to submit to a reduction of 6d. per ton upon the contracts made in January, as compared with 1878. Second-class coals of all descriptions in the county of Durham have a very fluctuating sale, and have to submit to a variety of prices; in fact, sales are very much a matter of bargain. It is not what the colliery owner will take, but what the customer will give. The second-class collieries of Durham can only pay a reasonable dividend to their owners when there is a pretty strong local demand. This is out of the question at present. The iron trade, unfortunately, does not give any indications of a revival. The chemical and other factories are likewise indifferently employed. If the coal owners get a good reduction of wages, they will simply prevent a loss. They cannot make a profit. The Northumberland steam coal trade is not improving, as regards price; but, generally speaking, the shipments of coals from the Tyne keep up an average not very far short of the most prosperous times. This will be made very apparent when it is stated that the shipment from one place alone—the Tyne Dock—was 85,000 tons in the last week of January.

There was not so much demand last week for steamers or sailing ships to load coals for the London market. Steamers were paid 4s. 3d. per ton. For sailing ships to discharge at the wharf, from 6s. to 6s. 3d., and, in some instances, 6s. 6d. may have been had; 6s. 6d. per ton has been paid steamers to load gas coals for Dublin; 9s. to 9s. 9d. sailing ships to Cork (gas); Exeter, 9s. (gas); Weymouth, 7s. to 7s. 7½d. (gas); Plymouth, 7s. 8d. (gas). Freights in the latter part of the week for steamers and sailing ships were about 3d. per ton below these quotations.

With regard to the general manufacturing trade, chemicals hardly kept so firm on the last two days of past week as they were on the last two of the previous week. Any upward tendency of prices was checked. There is a better demand for the higher class of fire-brick goods. Shipments have improved, notwithstanding the Baltic and half of the North of Europe is closed with ice. The inquiry has been principally coastwise, or for the North of France.

## TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

Last Monday evening, Mr. James M'Gilchrist, Manager of the Dumbarton Corporation Gas-Works, delivered a lecture on "Artificial Lighting" before the Literary Association of Luss—an important village on Loch Lomond. A portion of his lecture was devoted to the electric light, and in his concluding remarks he said: "As the world grew older the cry was ever becoming louder and stronger for 'more light.' Science, in the past, had listened and attended nobly to the want, and he had no doubt that she would, in the future, provide a light to supersede gas. The civilization and intelligence of all ages of the world's history were reflected in their systems of artificial lighting; and as every generation surpassed its predecessor in knowledge, there must of necessity, if history repeated itself, be a light produced to represent the culture of the times; but he was afraid that coal gas would be that light for many years to come." In the course of the evening, the lecturer lighted the front of the Free Church with coal gas, being the first time of that illuminating agent being introduced into the village. Some hope has been expressed that the lecture may soon lead to the establishment of the necessary agency for permanently lighting the village with gas.

The long talked-of experiments with the electric light, at the instigation of the Dundee Gas Commissioners, came off during the past week, commencing on Monday night. A good deal of interest was excited by the experiments, but they did not afford much satisfaction. The electricity was generated by a Gramme machine, driven by a gas-engine of 3½-horse power. Mr. M'Crae superintended the experiments, and at the same time there were exhibited in operation a number of gas-stoves, ovens, &c., together with a number of gas-lights, for the purpose of showing how gas may be wasted by the use of improper burners, or the non-regulation of pressure, and how the greatest amount of light may be obtained with the least cost.

Mr. M'Crae has just introduced into a street-lamp one of Sugg's new Argands, of 60-candle power. There will also shortly be exhibited one of double that illuminating power. I understand that the Glasgow and Aberdeen gas authorities are also moving in the direction of experiments with the same invention.

Mr. Macdougald, Public Analyst for the burgh of Dundee, is reported to have recently been very successful in devising a new economical burner for carburetting gas by means of naphtha, &c., instead of naphthaline, as in Livesey and Kidd's albo-carbon light. Including the price of the naphtha, it is said that the advantage in favour of Mr. Macdougald's burner is as 38 candles to 27 candles by ordinary gas; and it is stated that the inventor has a device whereby street lighting may be increased in the ratio of those numbers without additional cost, save that incurred by the slight trouble connected with the system.

On Saturday, the 1st inst., Aberdeen Corporation gas annuities changed hands at £5 17s. 6d., and on Tuesday at £5 18s. 6d. Edinburgh and Leith Gas Company's shares were disposed of on Monday at £28 10s., and on the same day an odd lot of Glasgow 9 per cent. annuities were sold at £206. On Friday, however, the regular price was £208, at which business was done, the 6¾ per cents. remaining firm at 156.

The Blantyre Local Authority have resolved upon adopting the water-supply scheme, which is estimated to cost £11,600, to provide 30 gallons per head per day to an estimated population of 6000.

Last week's Glasgow pig iron warrant market was very steady, but only a small amount of business was done. There were transactions on Friday down to 42s. 5d. cash. The orders offering for manufactured iron grow less and less, while the competition to obtain them grows greater.

No improvement in the coal trade has shown itself during the past week. Owing to the favourable change in the weather, the exceptional demand for house coal is easing off. The shipping business is still very slow.

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Reduction in the Price of Gas at Frodsham.—The Directors of the Frodsham Gas Company have given notice of a reduction in the price of gas from 5s. 5d. to 5s. per 1000 cubic feet, such reduction to date from the 1st ult.

Lamborne Gas Company.—At the annual general meeting of this Company, held on Monday, the 3rd inst.—Mr. H. Hippisley in the chair—a dividend of 5 per cent. was declared, and a vote of thanks was passed to the Secretary (Mr. W. Maberly) for his excellent management of the Company's business.

Boston (Lincolnshire) Water-Works Company.—The annual meeting of this Company was held last Thursday, when the report was read, and a dividend of 9 per cent. was declared. The works and appliances were reported to be in excellent condition. The reserve-fund was put down on the 6th of January at £241 12s. 11d.

Midland Association of Gas Managers.—The Annual General Meeting of this Association was held last Thursday, at the Midland Hotel, Birmingham, and a report of the proceedings will appear in our next issue.

Sale of Water-Works Shares at Yarmouth.—Last Wednesday, 400 preference 5 per cent. shares in the Yarmouth Water-Works Company were offered for sale by auction. The shares were sold in lots of ten, and realized from £10 to £11 per share, most of them going at £10 18s. and £10 19s. Mr. Ayris, the Manager of the Company, and also of the Norwich Water Company, was the principal buyer, either for himself or on commission.

Cannock Gas Company, Limited.—The ordinary annual meeting of this Company was held on Monday, the 3rd inst.—Mr. F. Gilpin in the chair. The balance-sheet showed a profit for the year of £760 6s., of which £280 was paid as a dividend, at the rate of 7 per cent. per annum, for the half year ending June 30, 1878. A further dividend, at the rate of 8 per cent. per annum for the past half year, was declared, amounting to £320; £158 4s. 6d. was added to the reserve-fund, making a total reserve of £480, the remainder of the profit being carried to the present year's revenue account. Messrs. Gilpin, Crutchley, and Collins, the retiring Directors, were re-elected, as was also Mr. J. G. Fellows, the Auditor.

Brighton and Hove Gas Company.—In pursuance of the Standing Orders of Parliament, a special general meeting of this Company was held last Friday, at the London Offices, 29, St. Swithin's Lane—Mr. Webb in the chair. The meeting was called for the purpose of submitting to the Proprietors, for their approval, a Bill to be introduced into Parliament to authorize the Brighton and Hove Gas Company to construct additional works, and to permit the Company to supply lighting and heating other than gas, and also to raise additional capital; the Bill being one for conferring additional powers on the Company. Resolutions agreeing to the Bill were adopted, and the proceedings closed in the usual manner.

The Accident at the Witton Park Gas-Works.—The explosion of gas, on the 7th ult., at the works of the Witton Park Gas and Coke Company, by which 14 individuals were more or less injured, has terminated fatally in one instance—that of Ralph Richards, who is said to have been the man who brought the lighted lamp near the gasholder. At first Richards's injuries did not appear to be of a very serious nature, and he seemed to be in a fair way towards recovery. On Sunday, the 26th ult., however, a relapse occurred, and he died at about eight o'clock in the evening. Two others of those injured—Chaytor and Newton—are said to be in a precarious condition, and fatal terminations are hourly expected. At the inquest, a verdict of "Accidental death" was returned.

The Proposed Purchase of the Margate Water-Works by the Town Council.—At a meeting of the Margate Town Council on Tuesday, the 14th ult., a letter was presented from the Solicitor to the Water Company, in reference to the proposed purchase. It stated that it must be perfectly understood by the Council that £59,000 was the price for the works up to the 31st of December last, the Council taking all receipts, except unpaid rates, then due, and paying all expenses from that date, and paying interest at the rate of 4½ per cent. per annum on the purchase money. It also informed the Council that, unless the Company's terms were accepted on or before the 1st of March next, they would be withdrawn. Should the Town Council decide to purchase the works, the offer of the Directors was, of course, made subject to confirmation by the Shareholders. The letter was referred to the Water-Works Committee.

Godalming and Farncombe Water Company.—The annual meeting of this Company was held last Thursday—Mr. H. Moon in the chair. The report, which was read by the Secretary (Mr. John Debenham), stated that the well at Frith Hill was nearly completed, and the report of the Engineer was to the effect that a continuous and abundant supply of water was certain. The plans for the erection of the reservoir were in the hands of several contractors for competition. The reservoir would be so constructed as to be capable of supplying 5000 persons. The Company, it was believed, would be in a position to supply the public on or before the 1st of September next. The number of £10 shares allotted was 438. The balance in hand, after meeting every liability, was £478 2s. 4d. The chief items of expenditure had been, for land, £870; establishing the Company, £360 12s. 3d.; and analysis for the water, £63. The report was received and adopted, and Messrs. Curteis and H. Moon were re-elected on the Directorate. A vote of thanks to the Chairman concluded the proceedings.

The Supply of Gas to Rawmarsh.—At the meeting of the Rotherham Town Council on Wednesday, the 5th inst., it was decided to adopt the recommendations of the Council in committee in order to save the parliamentary expenses—1. That an offer be made to the Rawmarsh Local Board to supply gas in bulk at 2s. 3d. per 1000 feet, on condition that the Rawmarsh Bouard purchase all mains, services, meters, &c., at a sum to be agreed upon. This arrangement to be for ten years. Or if the Rawmarsh Board continue to take gas as at present, the Corporation, to prevent misunderstanding, are willing to extend the gas mains to any part of the district of the Rawmarsh Local Board, on the condition that the lamps are placed at a distance from each other not exceeding 70 yards, and to pay for a consumption of not less than 10,000 feet of gas per annum for each lamp. 2. That if such offer be accepted, the Corporation offer that the Rawmarsh Sewage Site shall be struck out of the Rotherham Borough Bill. 3. That such offers contained in paragraphs 1 and 2 be subject to the Rawmarsh Local Board withdrawing all clauses from their Bill relative to the Rotherham Corporation or their gas undertaking, and also to the Rawmarsh Board erecting gas works, and also their opposition to the Rotherham Borough Bill.

Frodsham Gas Company, Limited.—The annual meeting of this Company was held on Monday, the 3rd inst.—Mr. Samuel Walker in the chair. The Directors presented the report for the year ending Dec. 31, 1878, which stated that the business of the Company during the year had been satisfactory. The income from all sources amounted to £915 1s. 9½d., being an increase of £53 15s. 4½d. upon that of the previous year, notwithstanding the reduction made in the price of gas at the commencement of the year. The expenditure amounted to £609 8s. 7½d., leaving a balance of profit of £305 13s. 2d. Out of this sum it was deemed prudent to transfer £100 to the reserve-fund, which would then be £250, the remainder, together with the balance brought forward from the last account, and amounting in the whole to £390 11s. 5d., being available for distribution. The Directors recommended the payment of a dividend of 7½ per cent. for the past year, which would absorb £150, leaving £240 11s. 5d. to be carried forward. During the past year 260 yards of 2-inch main-pipes had been laid, the buildings at the works had been put in good repair, and the old chimney taken down and replaced with a new one, all of which had been paid for out of the year's revenue. The report was unanimously adopted, and it was resolved that a dividend of 7½ per cent. be paid in respect of the past year, as recommended by the Directors. Messrs. Joseph Ashworth and Samuel Walker were re-elected Directors, and Messrs. John Pollard and Charles E. Linaker were re-elected Auditors. A vote of thanks to the Chairman brought the meeting to a close.

POLLUTION OF RIVERS IN SCOTLAND.—On Monday, the 3rd inst., the annual meeting of the Association for the Preservation of the Rivers of Scotland from Pollution, was held in the Freemasons Hall, Edinburgh, the Marquis of Lothian presiding. The report advocated the appointment of Conservancy Boards throughout the country, who should have power to take steps for the prevention of river pollution, under the provisions of the Act of 1876, and suggested that the Council of the Association be empowered to petition the Government to appoint such Boards. The Chairman moved the adoption of the report, and said that the Association might be congratulated on the progress and usefulness of its work during the past year. He did not think that the Association had ever taken the initiative in any proceedings against offenders, its object having been chiefly to keep alive public feeling on the question. Sir J. Gibson Maitland seconded the motion, which was unanimously adopted. Mr. David Milne Home, of Milne Graden, moved—"That this meeting is of opinion that there ought to be in this country, as in most other countries, a department of executive, one duty of which should be to look after the pollution of rivers, and see that they are kept free from such gross pollutions as not only unfit them for their primary purposes, but convert them into carriers of nuisances in the districts through which they flow." Sir James Alexander seconded the motion, which was agreed to, and the proceedings terminated.

BODMIN GAS CONSUMERS COMPANY.—The fourteenth annual meeting of the Company was held on Monday, the 3rd inst.—Mr. S. Hick, in the chair. The Directors reported that the works and plant were in good condition, and that the consumption of gas during the year had been the largest on record. In order to carry out effectually the important alterations and extensions necessitated by the largely-increased consumption, there had been additional land purchased, adjoining the present site, at a cost of £135 6s. 8d. These extensions were nearly completed. The cost of the land and new plant had necessitated an outlay of £1370. The Directors had borrowed £750 on the security of the plant, and they recommended that a further sum of £300 should be raised by making a call of 6s. per share, and that the balance should be taken from the reserve-fund. The balance on the year's working was £554, and the Directors recommended that the usual dividend of 8 per cent. should be declared, and the balance be carried to the reserve-fund. The present price of gas to general consumers was 5s. per 1000 feet—the lowest charge made by the Company since their formation—and the Directors had decided to make a further reduction of 3d. per 1000 feet. The charge, therefore, from last Christmas would be 4s. 9d. to all who availed themselves of the discount allowed for prompt payment. The Chairman moved, and Mr. John Beswetherick seconded, the adoption of the report, and, after some discussion, the motion was agreed to without dissent. Messrs. Collins and C. P. Tonkin, the Directors, who retired by rotation, were unanimously re-elected. These gentlemen have been members of the Directorate from the formation of the Company, and the value of their past services was commented upon in warm terms by the proposers, seconders, and Chairman. Messrs. E. T. Crabb and J. R. Collins were re-elected Auditors. Votes of thanks were given to the Chairman, the Secretary (Mr. P. J. Wallis), and the Manager (Mr. J. Thomas).

CROFT AND HURWORTH-ON-TEES GAS COMPANY, LIMITED.—The forty-second half-yearly meeting of this Company was held on Monday, the 3rd inst.—Col. G. J. Scurfield in the chair. The Secretary (Mr. J. T. Hall) read the following report:—"Your Directors have pleasure in submitting the statements of account for the half year ending Dec. 31 last, which show the income during that period to have been £465 17s. 6d., and the expenditure on revenue account, £252 9s. 1d., leaving a balance as profit of £213 8s. 5d. From this sum it is proposed to declare a dividend at the rate of 6 per cent. per annum, payable on and after Monday, the 3rd of February, at Messrs. J. Backhouse and Co.'s bank. This will leave a balance of £78 8s. 5d. to carry to the credit of the reserve-fund, which will then amount to £132 14s. 7d. Your Directors have also pleasure in reporting that the consumption of gas has again increased during the past half year, and that its quality is satisfactorily maintained. They have had under their consideration the advisability of still further reducing the price, and have come to the determination to make a further reduction of 6d. per 1000 cubic feet, which they trust will have the effect of encouraging a greater consumption of gas. The new benches of retorts have been completed, and have resulted in a material saving in the cost of fuel. The expense of erecting these retorts has been defrayed out of the reserve-fund. The works and mains of the Company are now quite capable of meeting the increasing demands made upon them. One of your Directors—Mr. R. Brown—retires this year by rotation. He is eligible for re-election, and offers himself accordingly. It is not proposed to fill up at present the vacancy in the Board of Directors caused by the retirement of Mr. R. Thompson. Mr. T. Brunton also retires from the office of Auditor, but is eligible for re-election. The question of appointing another Auditor to fill the vacancy caused by the retirement of Mr. W. Thompson, will come before the Shareholders meeting." The report was agreed to, on the motion of the Chairman, seconded by Mr. A. Kitching. The retiring Directors and Auditors were re-elected, and the usual votes of thanks concluded the business.

## Register of New Patents.

### APPLICATIONS FOR LETTERS PATENT.

309.—PIEPER, C., Berlin, "A gas-power locomotive for tramways and for railways of secondary order." A communication. (Complete specification.) Jan. 25, 1879.

325.—PARAIRE, E. L., Regent's Park, London, "An improvement in electrical light apparatus." Jan. 27, 1879.

346.—DAVEY, H., Leeds, Yorks, "Improvements in water-meters, also applicable to water-pressure engines." Jan. 28, 1879.

350.—YOUNG, F., Fleet Street, and FREEMAN, J., Canonbury, London, "Improvements in apparatus for increasing and diffusing all kinds of artificial light." Jan. 28, 1879.

361.—GOULD, R. H., Battersea Park Road, London, "Improvements in fluid-meters." Jan. 29, 1879.

376.—STAINTON, W., St. Pancras, London, "Improvements in the means of preventing evaporation and the formation of ice in wet gas-meters and other apparatus where water or other liquid is used, which it is necessary to prevent from evaporating or freezing, such improvements being also applicable to the purposes of refrigerating and freezing." (Complete specification.) Jan. 29, 1879.

382.—IMRAY, J., Chancery Lane, London, "Improvements in electric lamps." Jan. 30, 1879.

389.—LAKE, W. R., Southampton Buildings, London, "Improvements in and relating to reflectors for electric-lighting apparatus." A communication. Jan. 30, 1879.

392.—SHAW, J., Paddock, Yorks, "Improvements in gas motor engines." Jan. 30, 1879.

405.—OWEN, H., South Kensington, London, "Improvements in apparatus for supplying water to water-closets, baths, lavatories, and for other flushing purposes." Jan. 31, 1879.

410.—FIELDING, J., Manchester, "An improved 'gallery' or 'globe holder' for fixing glass chimneys, globes, or shades for gas or other lamps." Feb. 1, 1879.

413.—GEDGE, W. E., Strand, London, "Improvements in stoves or heating apparatuses burning a mixture of gas and air or other fuel." A communication. Feb. 1, 1879.

416.—ANDREWS, J. D. F., Charlton, Kent, "Improvements in electric lamps." Feb. 1, 1879.

427.—DUBOS, C., Paris, "Improvements in electric lamps." Feb. 3, 1879.

435.—HOUGHTON, A. B., Birmingham, "Certain improvements in hydrants and stand-pipes, also applicable to other analogous purposes." Feb. 3, 1879.

437.—DENHAM, W. H., Portsmouth, "Improvements in the construction of sewage works, and in utilizing and disposing of sewage, house refuse, and scavenged matters." Feb. 3, 1879.

452.—PRICE, J., jun., Liverpool, "Improvements in and relating to apparatus for heating or cooling liquids or gases, and for condensing and other kindred purposes." Feb. 4, 1879.

### PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3045.—CLERK, D., Glasgow, "Improvements in gas-motor engines." Aug. 1, 1878.

3068.—KESSELER, C., Berlin, "Improvements in self-regulating gas-burners." A communication. Aug. 3, 1878.

3153.—SUGG, W. T., Westminster, "Improvements in gas-regulators." Aug. 9, 1878.

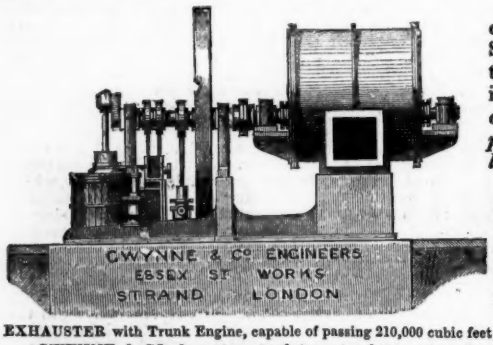
3225.—BOYNTON, L. W., Hartford, U.S.A., "An improved liquid-meter." Aug. 15, 1878.

3518.—MOLISON, A. R., Swansea, Glamorgan, "Improved electrical apparatus for igniting illuminating gas." Sept. 5, 1878.

3658.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in magneto-electric and electro-magnetic machines." A communication. Sept. 17, 1878.

**The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.**

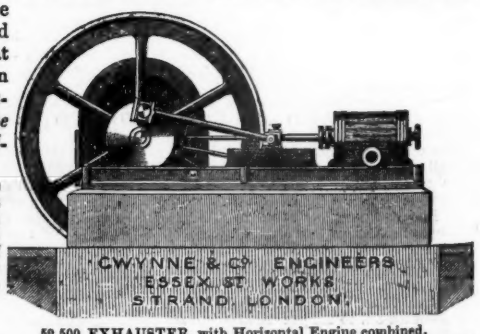
# GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.




EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.




52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

**Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.**

**PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.**

*Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.*

**WANTED, by a young Man, aged 22,** who has had five years experience in a Provincial Works (make, 75 millions), a SITUATION in a Gas-Works. Can use Photometer, fair Draughtsman, good Writer, quick at figures, and thoroughly understands general routine.
Apply S. I. C. E., 54, Hardress Street, RAMSGATE.

**WANTED, by a respectable Young** Man, an Appointment as METER INSPECTOR, COLLECTOR, or to assist Manager of a Gas-Works. Is a good writer, and could assist in the office work. Has a thorough practical knowledge of the Gas-Fitting department, and also experienced in Superintending Workmen. Excellent testimonials.
Address No. 524, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, by Samuel Thompson & Co.,** Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.
John Leigh, Esq., M.R.C.S., F.C.S., &c .&c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

**MANAGER** of Tar and Ammonia Distillery will be disengaged on the 10th of February, and will be open for RE-ENGAGEMENT.
Advertiser has a good practical knowledge of the business, and is a steady, energetic man.
Address No. 520, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**FOR SALE.—Upwards of 100 Tons of** SPENT OXIDE of IRON.
Apply to Mr. EUNSON, Gas-Works, NORTHAMPTON.

TO GASHOLDER MAKERS.

**THE Oldham Corporation Gas-Works** Committee invite TENDERS for Supplying and Erecting One TELESCOPIC GASHOLDER, 100 feet diameter, at their Higginshaw Gas Station.
Plans and specification can be seen on application to Mr. Herbert Andrew, Gas and Water Offices, Oldham.
Tenders to be sent in on or before Tuesday, the 25th inst.
By order,
Oldham, Feb. 6, 1879. H. BOOTH, Town Clerk.

WEIGHTS AND MEASURES ACT.

**LYON'S Patent Weighing, Measuring,** and Registering Machines. Respectable Agents Wanted.
Address Arnold E. ROBINSON, City Buildings, Corporation Street, MANCHESTER.

TO FIRE-CLAY RETORT MANUFACTURERS.

**THE Gas Committee of the Corporation** of Stafford are open to receive TENDERS for RETORTS and BRICKS.
Quantities and sizes will be supplied on application to the undersigned.
Tenders to be addressed to the Chairman, Gas Committee, Gas-Works, Stafford, and forwarded to me on or before the 22nd inst.
The Committee do not bind themselves to accept the lowest tender.
JNO. STORER, Manager.

TO TIMBER MERCHANTS.

**THE Gas Committee of the Corporation** of Stafford are open to receive TENDERS for the Supply of 31 Best Crown Memel TIMBER PILES, each Pile to be 35 feet in length by 12 inches square. To be delivered at the railway station, Stafford.
Tenders to be addressed to the Chairman, Gas Committee, Gas-Works, Stafford, and forwarded to me on or before the 22nd inst.
The Committee do not bind themselves to accept the lowest tender.
JNO. STORER, Manager.

ALLIANCE AND DUBLIN CONSUMERS GAS COMPANY.

**THE Directors of this Company are pre-** pared to receive TENDERS for the TAR produced at the Dublin Works, the quantity being about 800,000 gallons per annum. The contract to be for Three or Five years, to commence on March 1, 1880.
Further information can be obtained on application to the undersigned, with whom tenders are to be lodged on or before Tuesday, the 25th inst., endorsed "Tender for Tar."
W. F. COTTON, Secretary and Manager.
Offices, 114, Grafton Street, Dublin,
Feb. 6, 1879.

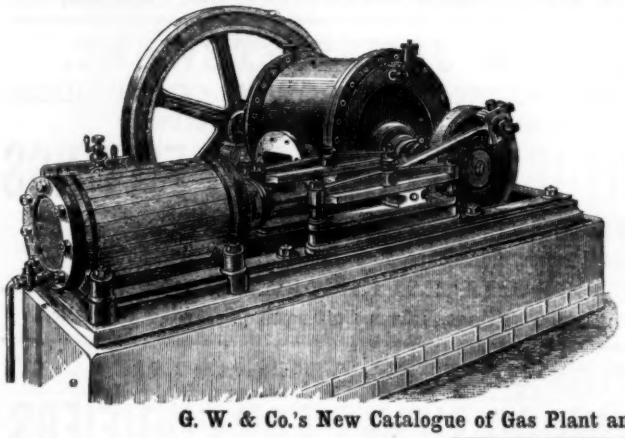
TENDERS FOR TAR AND AMMONIACAL LIQUOR.

**THE Directors of the Mirfield Gas Com-** pany, Ravensthorpe, are prepared to receive TENDERS for the TAR and AMMONIACAL LIQUOR produced at their Works for One year, from April 1, 1879, to March 31, 1880. Coals carbonized, about 5000 tons per annum.
Tenders to be sent in at per ton, separately, not later than Monday, the 3rd of March, endorsed "Tender for Tar," or "Ammoniacal Liquor," to
SAMUEL DAY, Secretary.

**THE Gas Committee of the Leeds Cor-** poration are prepared to receive TENDERS for the Supply of Wet and Dry GAS-METERS, to be delivered at their Gas-Works during a period of twelve months from the 1st of March next.
Each party tendering is required to send two sample 3-light Meters of each description offered (one of which is to be unscreened for examination), addressed to Mr. Woodall, Gas-Works, Meadow Lane, on or before Thursday, the 13th inst., from whom forms of tender may be obtained.
Tenders, addressed Chairman, Gas Offices, Boar Lane, and endorsed "Tender for Meters," will be received not later than Wednesday, the 19th inst., and the Committee do not bind themselves to accept the lowest or any tender.

**THE MITCHAM AND WIMBLEDON** DISTRICT GASLIGHT COMPANY.
INCORPORATED BY ACT OF PARLIAMENT, 1867.
NOTICE is hereby given that the TWENTY-FOURTH ORDINARY HALF-YEARLY GENERAL MEETING of the SHAREHOLDERS of this Company will be held in the Board-Room at the Works, Mitcham, in the County of Surrey, on TUESDAY, the 25th day of February, 1879, at Three o'clock in the afternoon precisely, to declare a Dividend for the half year ending the 31st day of December, 1878, to elect two Directors and one Auditor, and for general business.
The Directors who retire by rotation at this meeting are James John Stevens and James Page, Esqs., who, being eligible, offer themselves for re-election.
The retiring Auditor is John Edward Sandell, Esq., who, being eligible, also offers himself for re-election.
The Transfer Books will be closed from the 11th to the 25th day of February inst.
By order,
BENJAMIN GREEN, Secretary and Manager.
Board-Room, Mitcham, Surrey, Feb. 5, 1879.


# BEALE'S IMPROVED PATENT GAS EXHAUSTERS



WITH
Wrought-Iron Spindles and
ENGINES COMBINED.

SOLE MAKERS,
**GEORGE WALLER & CO.**

MAKERS OF ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

Phœnix Engineering Works:
HOLLAND STREET, SOUTHWARK, S.E.

# TO GAS ENGINEERS.

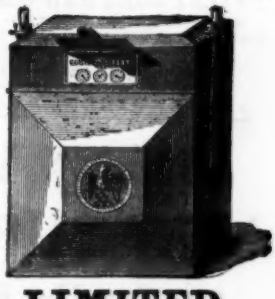
D. BRUCE PEEBLES & CO.

Beg to call the attention of Gas Engineers to the fact that the novel and original feature in connection with PEEBLES' SYSTEM OF CONTROLLING THE ACTION OF GAS GOVERNORS is the loading or acting on the Bell by Pneumatic Pressure instead of Weights.

TAY WORKS. BONNINGTON, EDINBURGH.

# DRY GAS-METERS,

*As supplied to The Gaslight and Coke Company, of London, and to the other principal Gas Companies.*



THE IMPERIAL METER CO., LIMITED,
WET AND DRY GAS-METER WORKS,
KING'S ROAD, ST. PANCRAS, LONDON.

CHEMICAL WORKS TO LET.

**THE Burnside Chemical Works, Ayr,** for the distillation of Gas Tar and Water, Manufacture of Sulphate of Ammonia, Naphtha, Oil, Pitch, Lamp Black, &c.

The Works are presently occupied by Messrs. Walker and Son, and are very conveniently situated for communication by rail and sea.

Apply to JAMES CAMPBELL, Writer, SALTCOATS.

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TENDERS FOR TAR.

**THE Gas Committee of the Dewsbury** Corporation are prepared to receive TENDERS for One, Two, or Three years (as may be agreed upon) commencing on the 1st of March next, for the purchase of the Surplus TAR produced at their new Gas-Works, Savile Town, which are situated close to the canal. Quantity of Coals carbonized, 13,000 tons per annum. Any further information may be had on application to the undersigned.

Sealed tenders, endorsed "Tender for Tar," to be sent to Jesse Smith, Esq., Town Clerk, on or before the 18th of February next.

The Committee do not bind themselves to accept the highest or any tender.

CHAS. ARMITAGE, Engineer and Manager.

Gas-Works, Dewsbury, Jan. 29, 1879.

---

**THE CHORLEY IMPROVEMENT ACT, 1871.—AS TO GAS-WORKS.**

CONTRACTS FOR CANNEL AND COAL.

**THE Chorley Commissioners are desirous** of receiving TENDERS for CANNEL and Best Screened GAS COAL, to be supplied for a period commencing the 1st of September next, and to be delivered free at the Chorley Railway Station, or if carted, at the Gas-Works, Water Street, Chorley, as may be required.

Sealed tenders, endorsed "Tender for Coal," specifying the description of cannel or coal, the pits at which they are to be raised, the quantities proposed to be supplied, and the period of supply, to be sent to the undersigned, on or before the 18th of February next, stating also cash terms for monthly payments.

The Commissioners do not bind themselves to accept the lowest or any tender, but the person or persons whose tender may be accepted will be required to execute an agreement for the due performance thereof.

By order,

RICHARD JACKSON, Clerk to the Commissioners.

6, High Street, Chorley, Jan. 25, 1879.

---

WESTON-SUPER-MARE GASLIGHT AND COKE COMPANY.

**TO BE SOLD BY TENDER, a quantity** of GAS PLANT suitable for a medium-sized Gas-Works, consisting of a 30 ft. Gasholder, together with one Station-Meter. Capacity, 5000 ft. per hour, with three 8-in. Valves and connections complete.

Set of Six PURIFIERS, 9 ft. by 6 ft., and 3 ft. 6 in. deep, with Trays and two Centre Valves complete. Two Columns, two Guides, and frame belonging thereto.

One SCRUBBER, 8 ft. by 7 ft., with Iron Trays, Centre Table, and other necessary connections.

One 8-in. GOVERNOR, and also a quantity of piping and other miscellaneous articles.

The above are to be disposed of in consequence of recent extension and enlargement of the works.

Tenders to be sent addressed to the Secretary, and the Directors do not pledge themselves to accept the lowest or any tender

For further particulars apply to Mr. John Perry, Manager, or to

W. H. DAVIES, Solicitor, Secretary.

---

AMMONIACAL LIQUOR.

**MESSRS. Cotton and Mardon are pre-** pared to receive TENDERS for the whole of the AMMONIACAL LIQUOR produced at the Uxbridge Gas-Works for One year from Feb. 1, 1879.

Contractors to state price per 1000 gallons, from 6 degrees Twaddell and upwards, delivered into boats on the Grand Junction Canal along side the Works.

C. and M. do not bind themselves to accept the highest or any tender.

Gas-Works, Uxbridge, Jan. 27, 1879.

---

TO INVENTORS AND PATENTEES.

**MR. W. H. BENNETT, having had** considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

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TO ENGINEERS & MANAGERS.—CLIFTON'S

**PATENT COKE AND COAL BARROW**

Is acknowledged to be the best Barrow in the Market.

For particulars, with Drawings and Prices, apply to the Sole Makers,

THORNELOE & COMPANY,

ENGINEERS AND CONTRACTORS,

**57, BARBICAN, LONDON, E.C.**

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# BRAY'S

## NEW BURNER,

## 80-Candle Power.

**See Page 209.**

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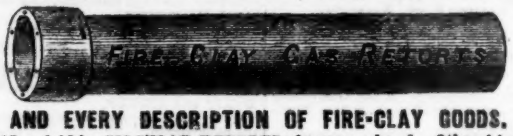
# JOHN HALL AND CO., STOURBRIDGE,

**Manufacturers of FIRE-BRICKS, LUMPS, TILES,**

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**ESTIMATES GIVEN FOR MAIN-LAYING.**

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## CLYDE TUBE WORKS, GLASGOW & COATBRIDGE.

OFFICES AND WAREHOUSE: 41, OSWALD STREET, GLASGOW.

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**FOR GAS, STEAM, AND WATER.**

Hot Water Tubes, Core Bars, Lap-welded Iron Boiler Tubes.

**CAST-IRON PIPES for GAS & WATER.**

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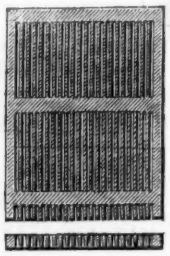

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**MADE BY SPECIAL MACHINERY.**

SCRUBBERS FILLED WITH BOARDS,

On our approved principle, for the extraction of Ammonia.

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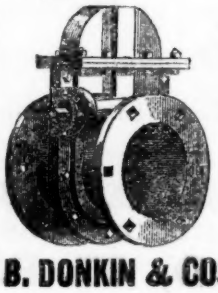
# IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

In ordering Valves, please state whether required for under or above ground, and if to be with flanges or spigots and sockets cast on, or with separate spigot and socket pieces.

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**STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS,**

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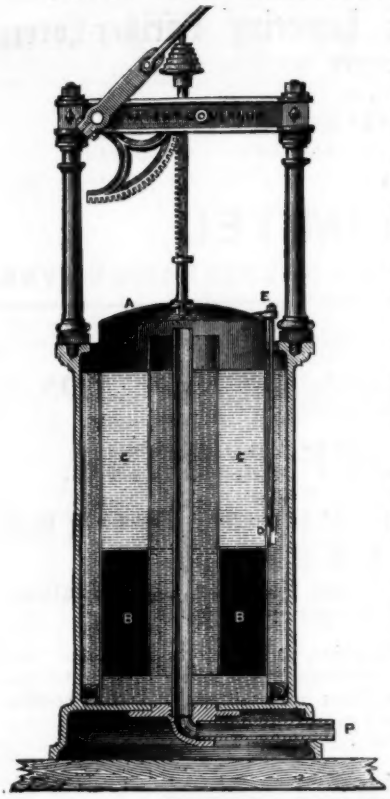
**Patent Compensating Steam Governor,**

WITH SELF-CONTAINED WATER-BALANCE.




**DESCRIPTION OF THE APPARATUS.**

The illustration represents a section of the Patent Governor. The lower part of the Bell A is fitted with a loose Float B, and in the upper part of the Bell is a deep annular Water Chamber C, at the bottom of which is an opening D, with a slide outside regulated by a Screw Spindle E, to allow the water to pass in and out of the Chamber C quickly or slowly, according to circumstances, but when once adjusted the slide does **not require altering.** This Self-compensating Chamber gives great steadiness to the up and down movement of the Bell and effectively prevents the "hunting" motion so common with other Governors, thereby ensuring a more perfect action on the throttle-valve of the Engine **than attained by any other.** The sketch shows the clip lever fixed to work on throttle-valve at an angle, and can work in either direction. P is the Gas Inlet-pipe to Governor.

G. W. & Co. also make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

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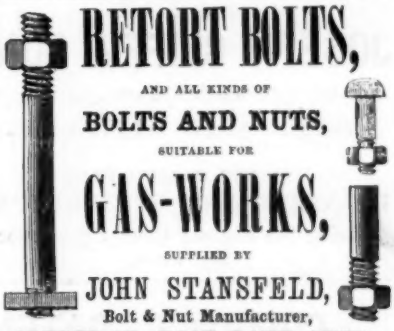
**PORTBURY, PATERSON, & CO.,**

MANUFACTURERS OF

Improved Wet and Dry Gas-Meters,

ALSO PATENTEES OF

**COMPENSATING WET METERS;**
INDICATORS,
STATION AND TEST METERS TO ORDER
STREET-LAMPS AND FITTINGS.
WORKS: WATERBEER ST., EXETER.



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**BOLTS AND NUTS,**

SUITABLE FOR

## GAS-WORKS,

SUPPLIED BY

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**ECONOMY IN THE PRODUCTION OF GAS.**

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FOR JOINTING AND REPAIRING RETORTS AND OVENS *in* ACTION AND *out* OF ACTION.
A Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,
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**Samples on application.**

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## AFFECTING GAS AND WATER UNDERTAKINGS.

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This Work contains information with regard to the practice of Parliament during the last fourteen years, in regard to most of the points on which differences arise in Opposed Bills for Gas and Water Undertakings, comprising—Authorized share and loan capital, Rates of dividend, Capitalization of profits, Term for the repayment of loans, Instances in which new shares are to be sold by auction and Exceptions to the Standing Order requiring new shares to be sold by auction, The limitation of back dividends, Illuminating power, Purity, Price, Notice before testing, The conditions under which the public supply of gas is regulated, Alteration of mains, Instances in which maps of mains are required, and All cases in which undertakings have been transferred, since 1845 in gas and 1865 in water, from Companies to Local Authorities.

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**SULPHATE OF AMMONIA APPARATUS,**

IN SUCCESSFUL OPERATION AT THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD GAS COMPANY.

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**THREE MEDALS**

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SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to their compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

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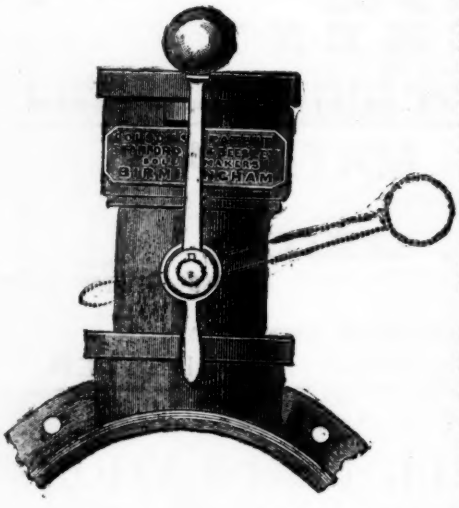
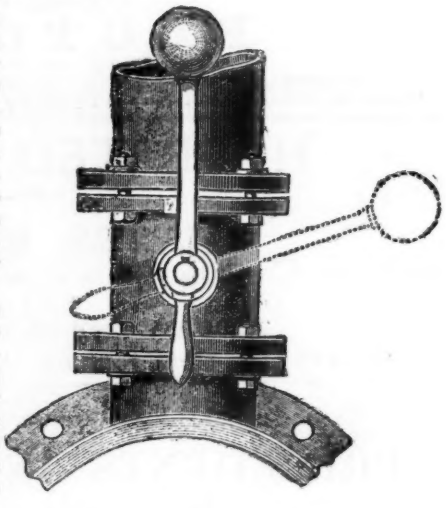
## COLSON'S PATENT ASCENSION-PIPE THROTTLE-VALVE.



THIS Valve is designed to supersede the hydraulic seal, and is intended to be placed immediately in or on the retort mouthpiece, or at such a distance therefrom as to be within reach of the workman. By the use of these Valves, the whole of the pressure is removed from the retorts, and a largely increased make of gas per ton obtained; the deposit of carbon is very slight, choked ascension-pipes are unknown, and the quality of the coke is improved.

When the retort is being drawn or charged, the lever, which is attached to a Spindle and Throttle-Valve, is thrown over as shown by the dotted lines, thereby closing the ascension-pipe; but when the retort is sealed, the lever is placed in a vertical position, and a free way made for the gas to pass to the relieving main.



The Valves (upwards of two hundred in number) supplied to the Gas Committee of the Corporation of Birmingham, for their Windsor Street Works, continue to give complete satisfaction, and no difficulty has been experienced in working retorts fitted with them in combination with others worked in the usual way with the hydraulic seal.

The following important testimonial has been received:—

*Corporation of Birmingham Gas Department, Windsor Street Works, Feb. 17, 1878.*

MESSRS. STANFORD AND BEESLEY.

DEAR SIRS,—In reply to your inquiry, I beg to say that the Valves (Colson's Patent) supplied by you in July last have given entire satisfaction. The retorts fitted with them are worked side by side with others having the ordinary dip-pipe, without any difficulty being experienced.

Yours truly, (Signed) CHARLES HUNT.

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**WANTED, Readers of the NEW Edition,** 1879, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, A.I.C.E., Gas-Works, SYDENHAM, S.E.

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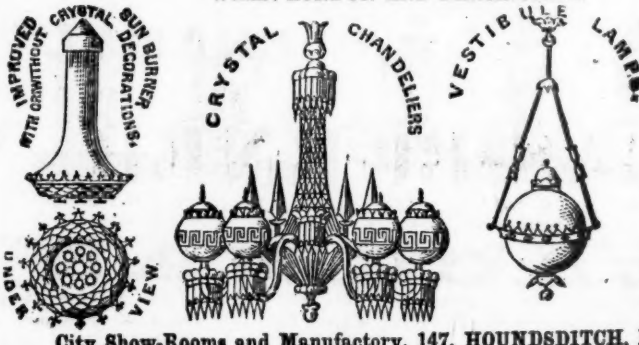


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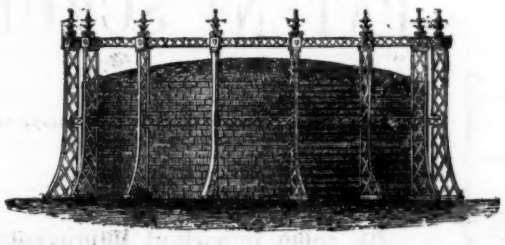

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## GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

## S. OWENS & CO.,

WHITEFRIARS STREET, FLEET STREET, LONDON, E.C.,

Hydraulic Engineers,

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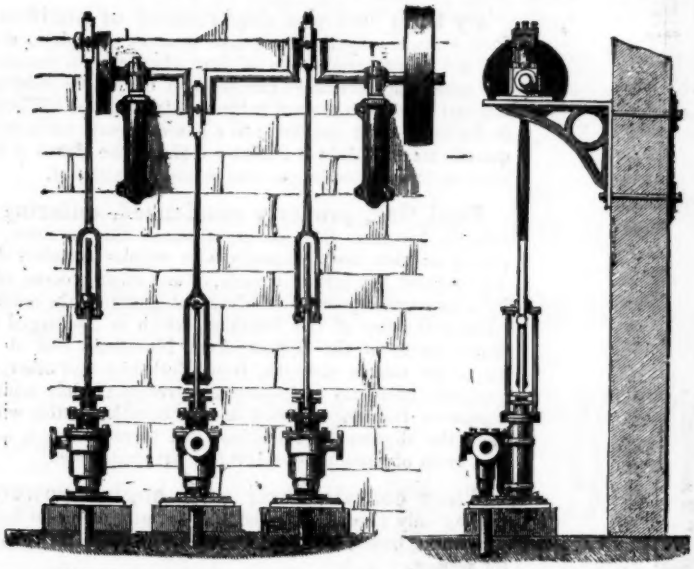
PUMPING MACHINERY of every Description.

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF

BLAKE'S PATENT DIRECT-ACTING STEAM-PUMPS.



IMPROVED DOUBLE-ACTION PUMPS.

For Water. For Tar. For Ammoniacal Liquor.

This illustration shows an arrangement of three (No. 179) Improved Double-Action Pumps driven from the same crank-shaft, as frequently supplied for use in Gas and Chemical Works. The suction and discharge pipes can be arranged for drawing from and delivering in any required direction.

These Pumps have been supplied to nearly all the large Gas Companies and Chemical Works, both for Pumping Water, Tar, and Ammoniacal Liquor.

AS SYPHON PUMPS, IN COPPER OR SHEET IRON, ALWAYS IN STOCK.

Illustrated Catalogues sent post free on application.

## YEO'S PATENT ENGINE PACKING,

Price 1s. 8d. per lb., any size.

Tarred & White Spun Yarn for Pipe Joints, at various prices.

Samples and testimonials free per post.

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

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Keep in London and at their works large stocks of PIPES and CONNEXIONS (1½ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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## SILICA FIRE-BRICK CO.,

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Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

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Of all Dimensions for Gas-Works,

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Of every kind.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture.

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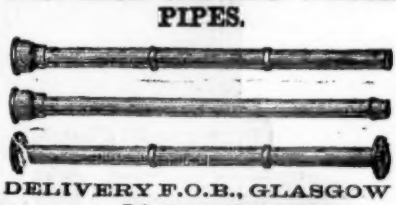
CAST-IRON GAS AND WATER PIPES.



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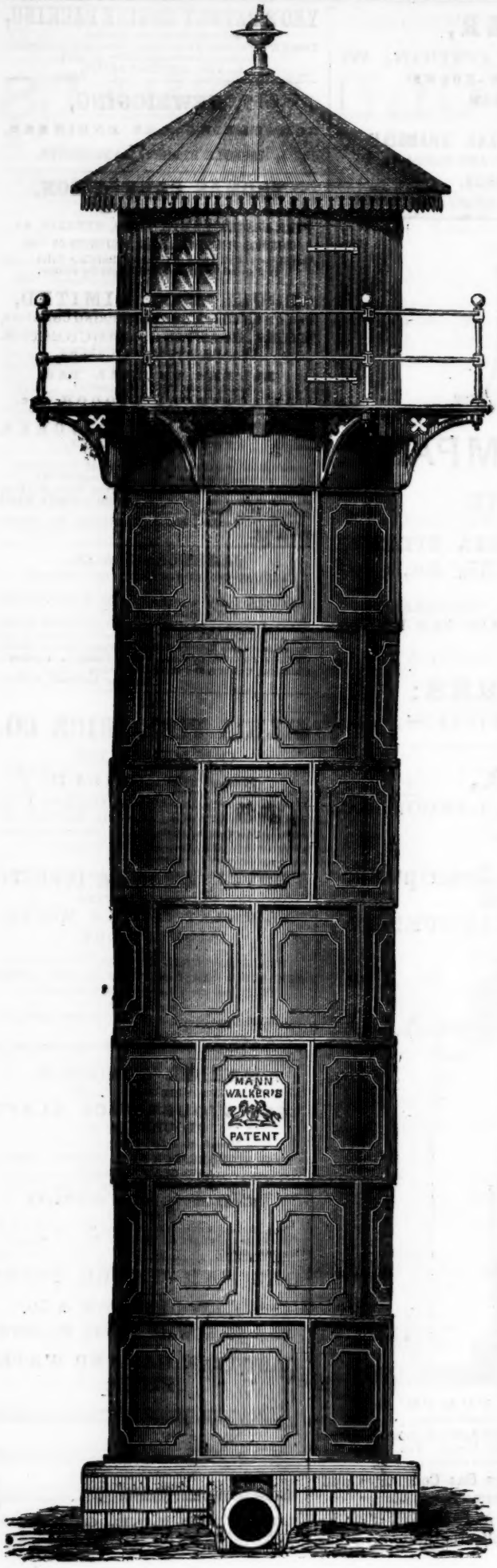
*Prices on application.*




C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

# MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

**By some important improvements recently** patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

**It is to be particularly noted that the im-** portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

**Fifty million cubic feet of gas per 24 hours** are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

**Generally, wherever a high standard of** purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

**By their use the department of purification** from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

**Foul Gas, properly condensed, entering the** inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

**They contain their own engine power, re-** quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

**Applications relating to dimensions and** prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

THE

# ONLY TWO GOLD MEDALS

FOR

## GAS-BURNERS & GAS-METERS,

BRITISH SECTION,

**PARIS EXHIBITION,**

1878.

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The International Juries of the Paris Exhibition have awarded to

## WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, VINCENT STREET,

**WESTMINSTER, S.W.,**

# ONE GOLD MEDAL, Class 27,

FOR HIS

**PATENT GAS-BURNERS, PATENT LAMP-GOVERNORS,**

AND

**PATENT CONSUMERS DRY GOVERNORS;**

AND ALSO

# ONE GOLD MEDAL, Class 53,

FOR HIS

**PATENT ILLUMINATING POWER METERS,**

**IMPROVED JET-PHOTOMETERS, PHOTOMETER METERS,**

AND

**IMPROVED COMPENSATING WET METERS**

WITH

**SIMPLE INDEX.**

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Prices and Particulars on application to

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**GAS ENGINEER, VINCENT WORKS, WESTMINSTER**

## ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

### SHOTT'S BOGHEAD.

### HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

### THRASHBUSH CANNEL

Yields 12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

### LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

### MUIRKIRK, No. 1, CANNEL

Yields 13,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

### OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSSON AND CO., 21, Lime Street, LONDON, E.C.

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GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

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## HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,594 cubic feet per ton of 14¼-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

---

## HOLMSIDE GAS COALS.

*South Metropolitan Gaslight and Coke Company,*
589, *Old Kent Road, London, S.E.,*
*Oct.* 9, 1873.

At the request of Mr. Hedley, the owner of the Holmside Colliery, I have much pleasure in stating that, for about ten or twelve years past, this Company has taken at least half of its supply of Newcastle Coal from him. I can, therefore, confidently bear testimony to the good quality of the Holmside Coals, and consider they are equal to the best of the Newcastle Coals, in proof of which I may state that this year we are using those Coals exclusively, that the yield of Gas is from 9700 to 9800 feet per ton, and that the quality of the Gas, without any admixture of Cannel, is over 16 candles, as tested by the officer appointed by the Metropolitan Board of Works, using the London Gas Referees test.

The Coke is of excellent quality, and in quantity amounts to about 40 bushels from a ton of Coal.

The annual consumption of Coal amounts to about 75,000 tons.

GEORGE LIVESEY, Engineer and Secretary.

P.S.—I am at this date, Feb. 15, 1875, still using Holmside Coals as largely as ever, and am quite as well pleased with them as when I gave the above certificate.

GEORGE LIVESEY.

We are this year, 1878, using 60,000 tons of Holmside Coal. GEORGE LIVESEY.

FITTING OFFICE:
Address, 75, QUAYSIDE, NEWCASTLE-ON-TYNE.

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## M. BREMOND'S NAPHTHALINE PROCESS.

All negotiations respecting M. Brémond's patented process for preventing Deposits of

NAPHTHALINE

in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Companis Madrilena de Alumbrado y Calefaccion por Gas, MADRID, who may be consulted upon all matters connected with the Gas Industry.

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AGENT FOR
THOMAS BARR'S LESMAHAGOW MAIN CANNEL,
AND
NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

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## WILSON CARTER AND PEARSON,
GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:
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## GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,
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PATENTEE and MANUFACTURER of the following Invention

RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,
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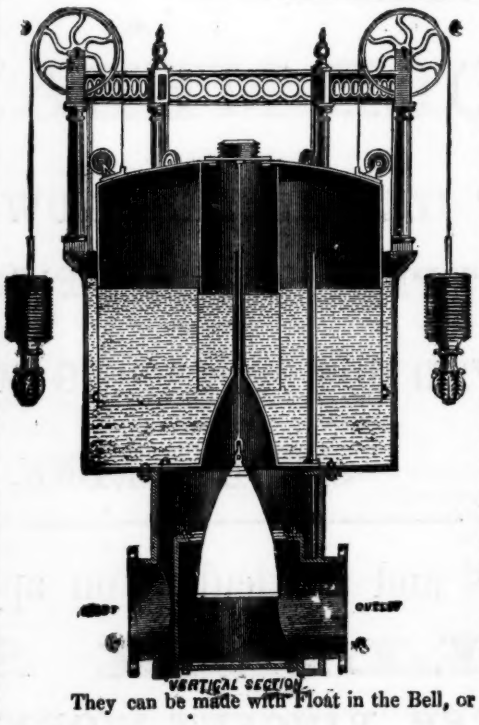
## J. & J. BRADDOCK,
GLOBE METER-WORKS,
OLDHAM,

Beg to submit to Gas Engineers their

## PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION.

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

# THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

**DODWORTH, BARNSLEY.**

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

## REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

**PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.**

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## LIVESEY FIRE-CLAY WORKS.

**NEAR BLACKBURN, LANCASHIRE.**

(ESTABLISHED 1835.)

# ORLANDO BROTHERS, LIMITED,

**MANUFACTURERS OF PATENT CLAY RETORTS,**

AND EVERY DESCRIPTION OF

**TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.**

**FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.**

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# THE FARNLEY IRON COMPANY, LIMITED,

**FARNLEY, near LEEDS,**

MANUFACTURERS OF

## FIRE-CLAY GAS-RETORTS & FIRE-BRICKS,

Of every size and shape, and of the best quality; also of White and Coloured GLAZED BRICKS, SANITARY PIPES, &c., &c.

In order to meet the constantly increasing demand for their Gas-Retorts, the F. I. Co. have recently made such an addition to their premises as will enable them to execute expeditiously the largest home or foreign orders.

**London Agent for Gas-Retorts: D. W. OGG, 3, Jeffrey's Square, St. Mary's Axe, E.C.**
**" " Glazed Bricks: A. BARFIELD, 22, Great George Street, Westminster.**

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# SULPHATE AMMONIA.

## R. W. WALLACE & CO.,

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Are Buyers of SULPHATE AMMONIA in Large or Small Quantities, or Sell on Commission for Gas Companies and Makers.

PLANT ERECTED ON THE LATEST AND MOST APPROVED PRINCIPLE.

AGENTS to THE GASLIGHT AND COKE COMPANY, LONDON, for the SALE of SULPHATE AMMONIA. Works: BECKTON.

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# NEWTON, CHAMBERS, & CO.,

## THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

## CELEBRATED SILKSTONE GAS COALS.

**The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.**

**A recent extensive development of the Collieries enables us to offer increased supplies.**

**JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—**

*"Warrington Gaslight and Coke Company,*
*Offices, Mersey Street, Warrington, April 23, 1877.*

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

**Full particulars will be sent on application to us—address as above.**

# CROLL'S
# DRY GAS-METERS,

PRIZE MEDALS.
LONDON, 1851;
NEW YORK, 1853
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(INVENTED & PATENTED IN 1844,)

COMBINING ALL THE LATEST IMPROVEMENTS,

MANUFACTURED ONLY BY

PRIZE MEDALS.
LONDON 1862;
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## THE GAS-METER COMPANY, LIMITED,

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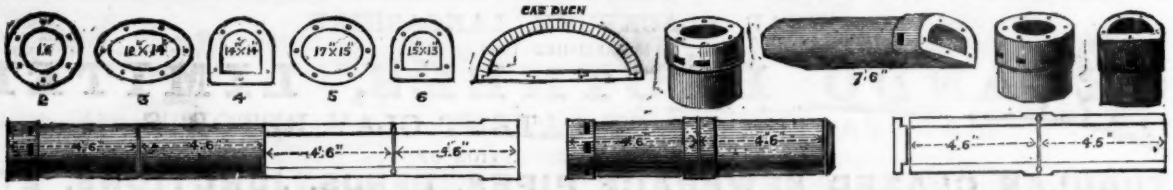


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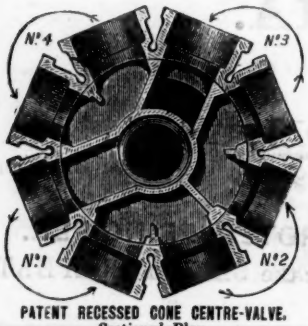
Proprietors of Best Clay Mines. Largest makers in the World of Gas-Retorts, Lumps, Tiles, Fire-Bricks, and Fire-Clay Goods of all kinds. 200,000 feet of Gas-Retorts of all Sizes and Patterns in Stock, all in good order. Orders for any Size executed on receipt.

**CAST-IRON GAS AND WATER PIPES,**
**WROUGHT IRON AND LEAD TUBING, GLAZED DRAIN-PIPES,**
**STAFFORDSHIRE BLUE BRICKS.**



PATENT RECESSED CONE CENTRE-VALVE.
*Sectional Plan.*

## R. LAIDLAW AND SON,

**EDINBURGH AND GLASGOW,**

SOLE MAKERS OF

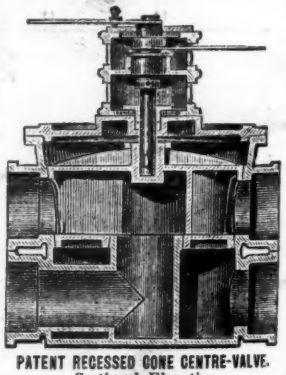
PATENT

RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.


PATENT RECESSED CONE CENTRE-VALVE.
*Sectional Elevation.*

**London Office: 6, LITTLE BUSH LANE, CANNON STREET.**

## D. HULETT & CO.

Invite the attention of Gas Companies, Corporations, and others to their

**PATENT STREET LAMPS,**

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE 10s. each, net. Special quotations for large quantities.
Also made **EXTRA STOUT** recommended for its durability, PRICE 11s. 6d. each.

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By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

**HULETT'S PATENT MERCURIAL REGULATOR,**

For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

PATENTEES OF IMPROVED WET AND DRY GAS-METERS.

**Makers of all kinds of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.**

GAS HEATING AND COOKING STOVES.

**55 and 56, HIGH HOLBORN, LONDON.**

London: Printed by WALTER KING, for the Executors of the late WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street), and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, February 11, 1879.